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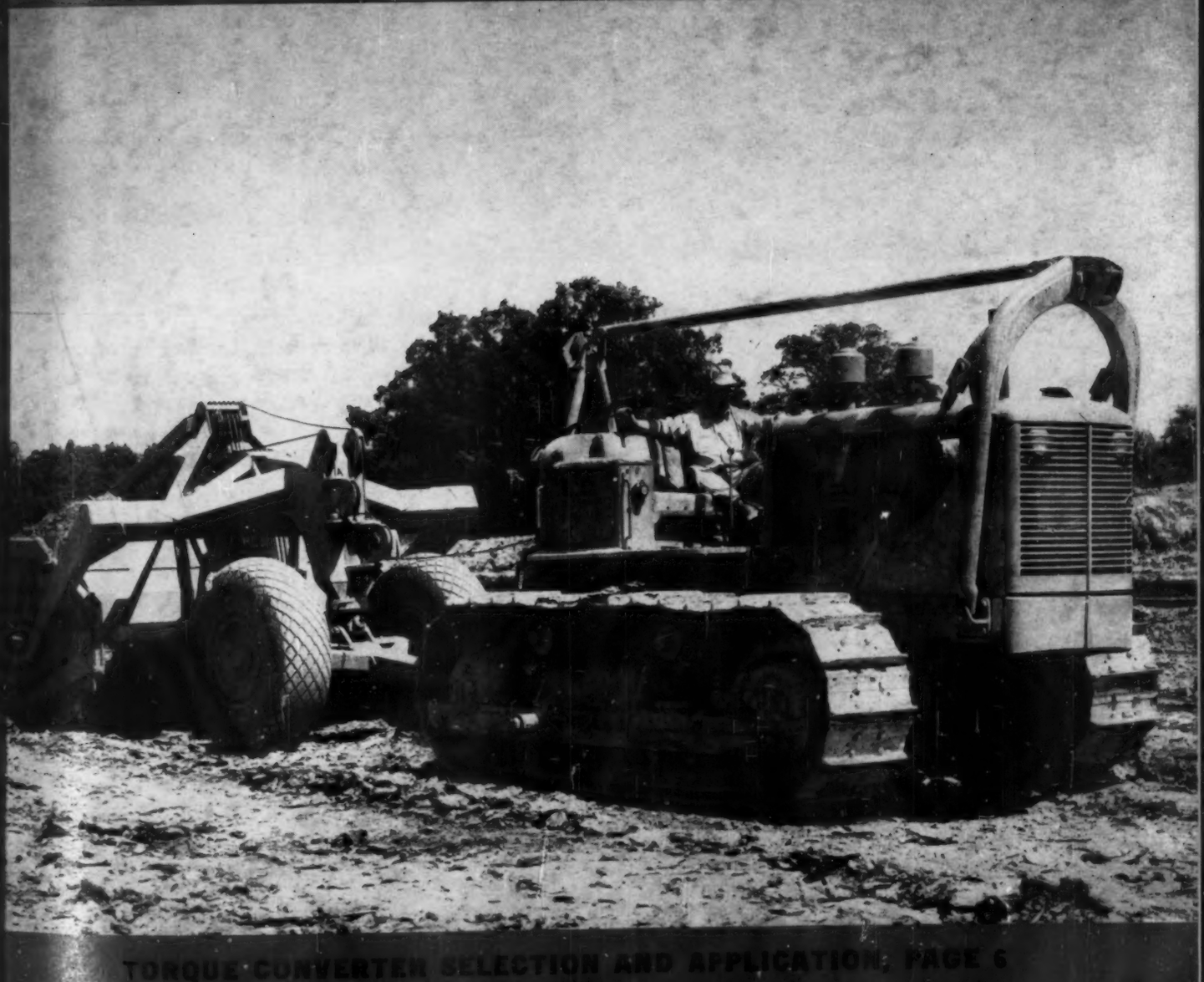
Applied HYDRAULICS

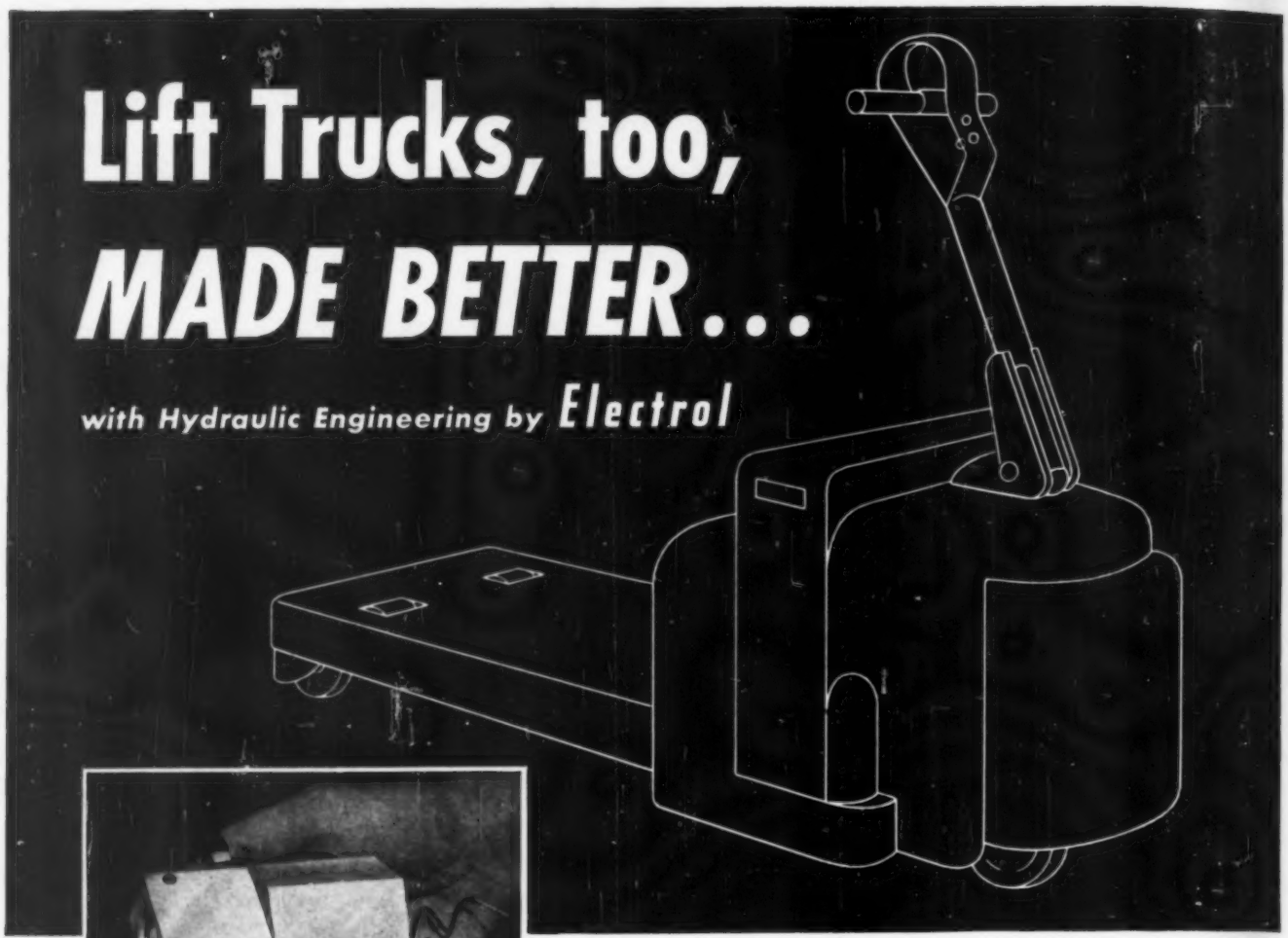
The Magazine of Hydraulic and Air Circuit Engineering

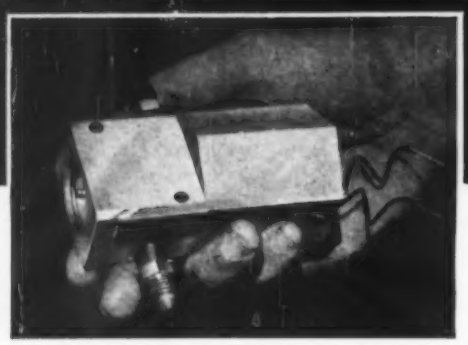


TORQUE CONVERTER SELECTION AND APPLICATION, PAGE 6
EXPLORING FOR OIL AND WATER, PAGE 10

Lift Trucks, too, MADE BETTER...

with Hydraulic Engineering by **Electrol**





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FRONT COVER: The Allis-Chalmers HD-19 diesel, largest and most powerful crawler tractor, is equipped with a three stage torque converter. Renke Brunken's story on the selection and application of torque converters begins on page 6.

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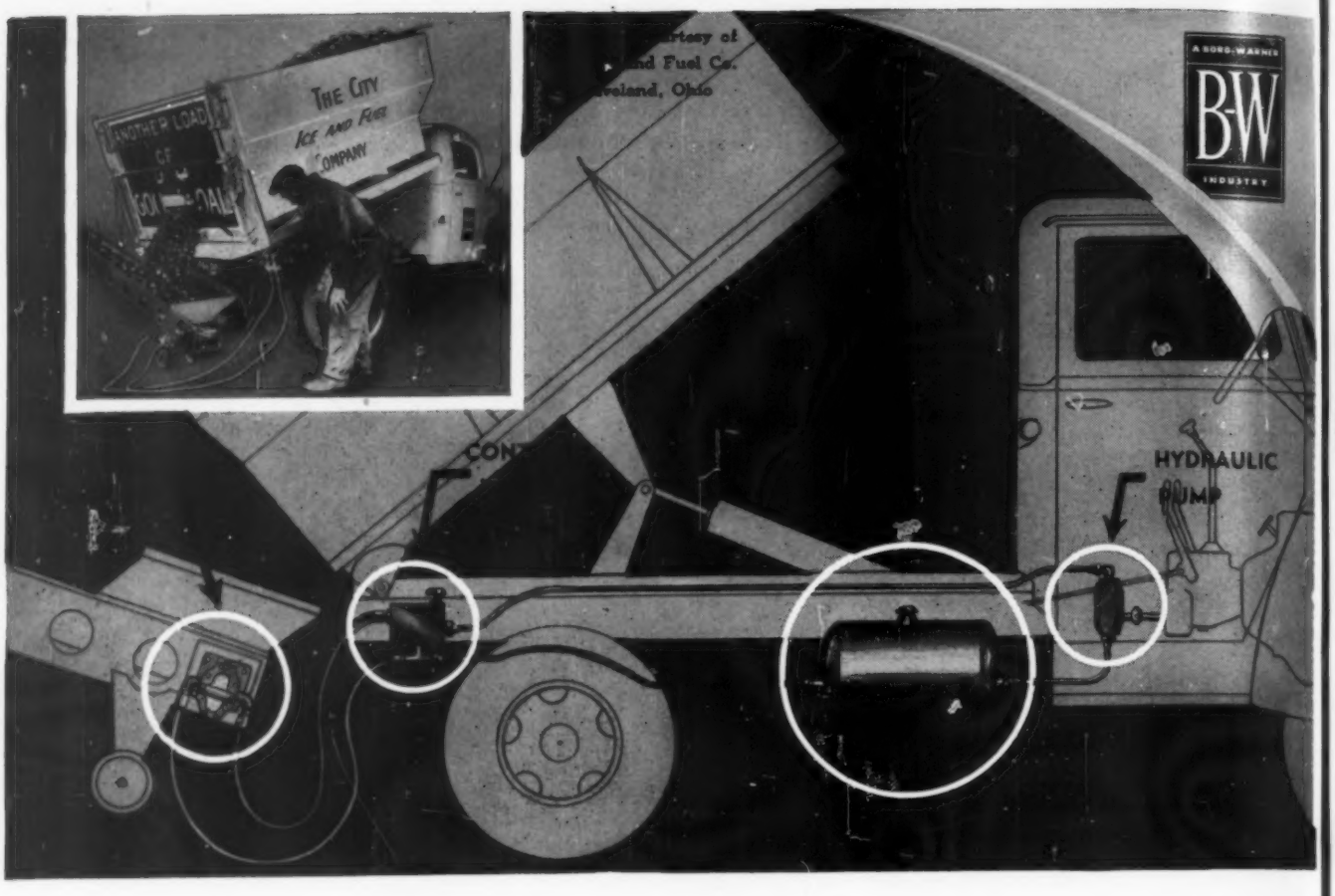

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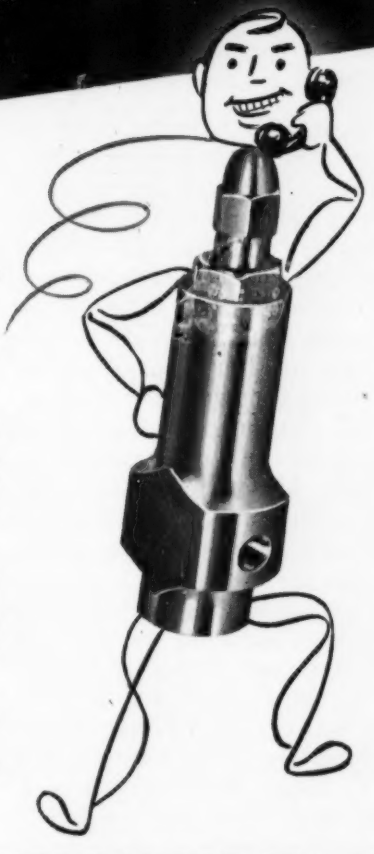

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TORQUE CONVERTER SELECTION and APPLICATION

A discussion of the basic data on hydraulic torque converters—their characteristics, rating and selection factors and methods of mounting. The torque converter, already established in several important industries, is entering its real development period; its advantages in the transmission of power are steadily gaining applications in a wide range of industries.

By RENKE BRUNKEN,
Transmission Engineer,
The White Motor Company

THE INTRODUCTION of hydraulic torque converters in the passenger car field confirms the success which they have enjoyed in heavier vehicles. The Dynaflow transmission recently announced for the Buick Roadmaster series is an automatic transmission of this type. This installation followed the introduction of the Spicer or Twin Disc (Lysholm-Smith) converter on General Motors buses and the White Hydro-Torque Drive as standard equipment on White coaches.

These three applications are most familiar today but they are definitely not the only torque converters in the field. In addition to G.M.C. and White Motor, such companies as Twin Coach, ACF Brill, Mack Truck and American Aero have adapted torque converters to their products.

One model of the large crawler tractors produced by the Allis-Chalmers Manufacturing Company has been equipped with a hydraulic torque converter.* On the West coast there are numerous applications on logging machinery and on oil well machinery. Hydraulic torque conventers are firmly established in these two fields. They have proved their merit by increasing production and contributing greatly to the reliability of the machinery. It is interesting to note that torque converters are gradually being adapted to steam shovel operations where, oddly enough, their success has been hampered by too much torque increase. Many converter installations were made on military vehicles during the war and they were extremely effective.

The recent application of the torque converter to passenger cars will be of inestimable value to the future development and general use of this type of transmission. Extensive research facilities and a large amount of capital will be used for development. Furthermore, the merits of torque converters will be brought to the attention of the greatest number of people as a result of passenger car applications.

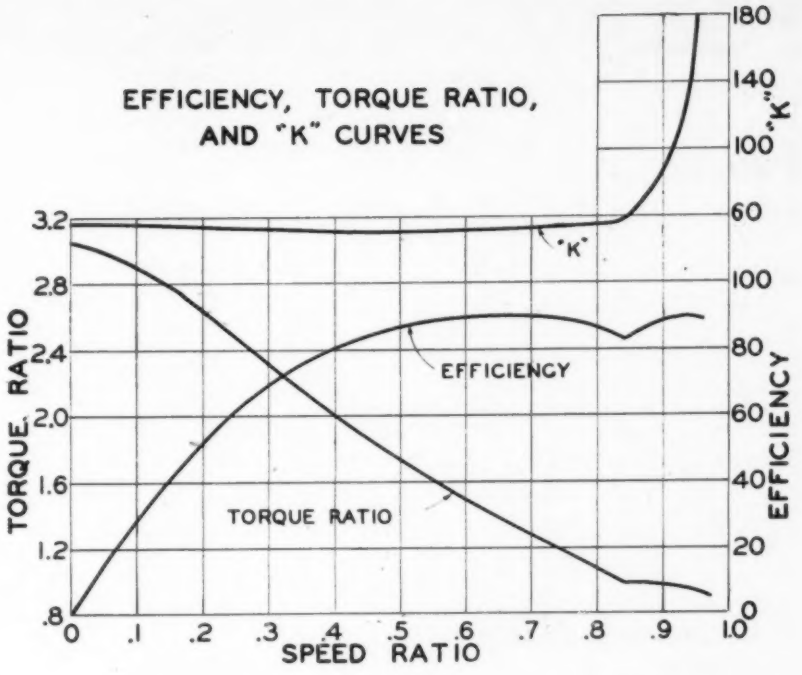
There are disadvantages to this form of transmission which should be thoroughly understood. However, it is firmly believed that the advantages far exceed the disadvantages.

Improved torque converters will foster interest in fields where their advantages are questioned at present. Research work is increasing steadily to improve converters. This research is being done not only by the companies building converters but also by the oil companies in an endeavor to furnish better fluids. Numerous experimental installations are under way with such applications as off-the-highway trucks used for mining and earth moving. Converters are ideally suited for use in the heavy duty truck. Other fields to conquer are those of the standard trucks, truck-tractors, farm tractors, motor cycles, motor scooters and possibly main line locomotives. For such applications, converters are perfectly within reason at this time considering performance and initial cost, as well as overall economy. While converters are rather expensive today, quantity production will inevitably lower the cost.

A paper delivered before the Machine Design Section, Cleveland Engineering Society, April 5, 1948.

*APPLIED HYDRAULICS, April, 1948, page 24.

Fig. 1. Efficiency, torque ratio and "K" curves.



Industrial applications are possible which, at the present time, cannot even be enumerated. I would like to take this opportunity to review the fundamental ideas of the proper selection and application of torque converters. Since my experience has been closely associated with the Schneider type converter, my remarks will apply specifically to that type.

Converter Characteristics

The most important basic formula for a converter is no different than for any other form of transmission. That is, the efficiency equals the torque ratio times the speed ratio. It is well to remember this relationship, it will enable the engineer to check back on his calculations. The basic information required for the selection of a torque converter is shown in Figure 1 and consists of the efficiency curve, the torque ratio curve and the "K" curve. The data shown is that of one type of a Schneider converter. A similar type is employed in the White coaches and is used in conjunction with a free wheel mounted reaction member, giving a combination of a hydraulic torque converter and a hydraulic coupling.

Since the nomenclature of hydraulic torque converters may not be too familiar, a few basic definitions may be helpful:

(1) the stalling speed of the converter is the speed which the engine at full throttle obtains with the output or turbine shaft stationary;

(2) the clutch point is the point at which the input torque equals the output torque;

(3) the speed ratio is the ratio of the output speed to the input speed;

(4) the torque ratio is the ratio of the output torque divided by the input torque.

The basic curves are the efficiency curve and the torque ratio curve. Since these curves are dimensionless, it is impossible to make other calculations from this data to determine which particular size converter should be used in conjunction with a particular engine. For this reason, it is necessary that additional information be available as to the absorption characteristics of a converter. This information can be supplied in a very simple curve which we have called the "K" curve. This "K" is a value determined experimentally and equals the quotient of the input speed divided by the square root of the input torque. The "K" curve, of course, pertains to a specific converter. The "K" curve is almost constant from the stalling point to the clutch point and under full throttle the speed of

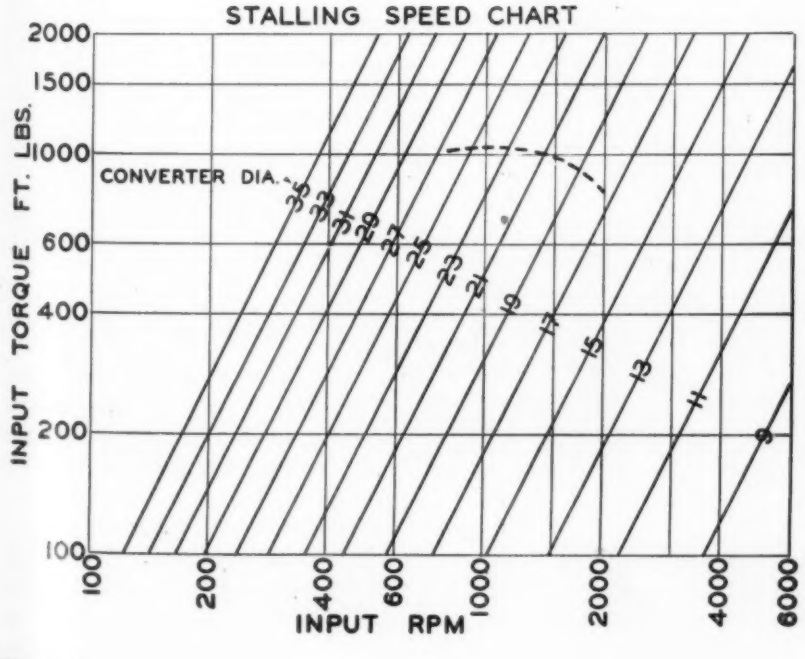


Fig. 2. Stalling Speed Chart.

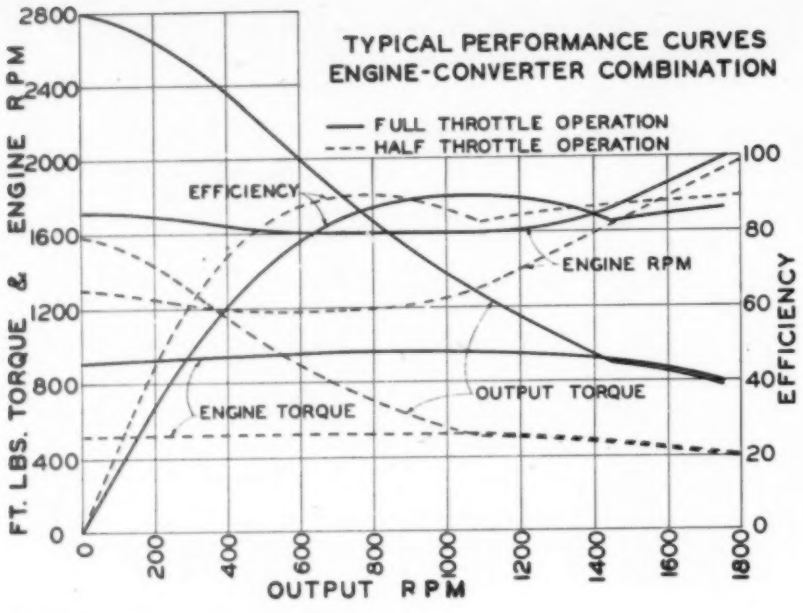


Fig. 3. Performance curves, engine-converter combination.

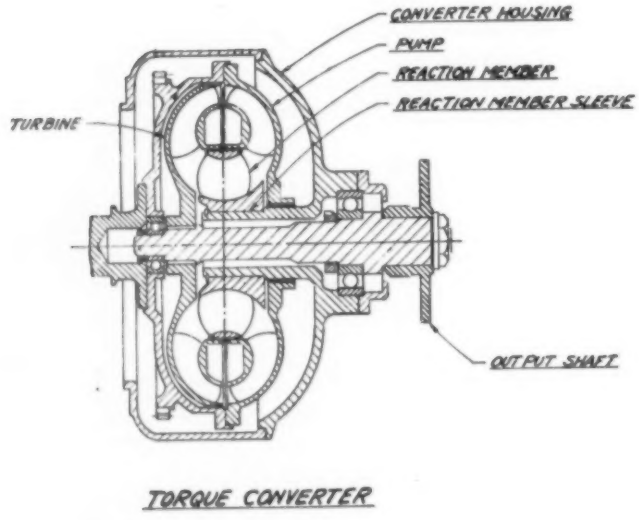


Fig. 4. Converter directly mounted to the engine flywheel.

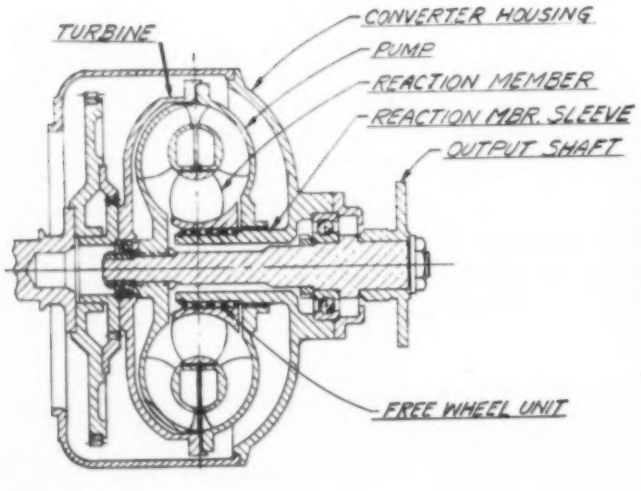


Fig. 5. Converter installation in which power is transmitted from engine to converter by slidable splined connections.

the engine performs quite similarly. After the clutch point the "K" curve rises. This is caused by the fact that at this point the reaction member, heretofore stationary, begins to rotate in the direction of the engine, thereby decreasing the resistance to the oil and permitting a higher absorption capacity.

Similarity Formulas

If it is desired to figure a different size converter from this curve, very simple similarity formulas are used. In using these formulas, it should be borne in mind that they are based on the supposition that a converter is changed exactly in proportion to the known converter and that they use the same fluid for transmission of power. These similarity formulas are as follows:

(1) the horsepower that a converter can absorb increases with the cube of the input speed and with the fifth power of the diameter;

(2) the torque that a converter can absorb increases with the square of the input speed and with the fifth power of the diameter.

This basic information will make it possible to figure any application of a torque converter provided the basic characteristics of one converter are known. Again, this presupposes that the converter must be changed exactly in proportion to the basic converter and that it operates on the same fluid. If, however, the fluid is changed, the absorption capacity will change with the specific weight of the fluid.

Specific Application

Let us now figure an example for this particular torque converter and assume the engine produces 910 ft-lb. Then, according to our "K" formula, the stall speed would be equal to "K" times the square root of engine torque which in this case equals 1720 rpm. Assuming that an-

other engine is available with one-half the torque or 455 ft-lb output, we would have a stalling speed of 1300 rpm. It is evident that it is extremely important that the proper size converter be chosen for a specific engine. If stalling speeds were known for various converters, this information would greatly aid in the preliminary selection of the correct converter. Stalling speeds can be obtained readily from a graph as shown in Figure 2, on which the input torque is plotted over the input speed on log paper. The influence of the speed and the diameter can be seen by examining the chart. For example, a 15 in converter at 1000 rpm absorbs 94 ft-lb and at 4000 rpm it absorbs approximately 1500 ft-lb, an increase with the square of the speed. This may be checked:

$$\left(\frac{4000}{1000}\right)^2 \times 94 = 1500.$$

By increasing the diameter and retaining the same input speed of 1000 rpm, a 27 in converter can transmit 1000 ft-lb, an increase with the fifth power of the diameter. This may be checked:

$$\left(\frac{27}{15}\right)^5 \times 94 \text{ or } 18.9 \times 94 = 1780 \text{ ft-lb.}$$

In making a preliminary selection, plot the engine torque on a stalling torque chart such as shown in Figure 2. Wherever the line of a specific converter crosses the input torque curve, the stalling speed for a particular engine may be read. It is obvious that several different converters could be selected for this specific engine.

For this engine let us select a 19 in diameter converter. By proceeding from the full throttle torque we can figure the output torque at the various speed ratios and the corresponding engine speeds as well, so that we arrive at a complete full throttle curve as shown in Figure 3. The engine performs at almost constant speed from the stalling point to the clutch point, dipping slightly in the middle. This is considered an advantage as the operator judges from the sound of the engine as to whether it is pulling and delivering at full capacity. The dip in the engine speed gives him this assurance. Beyond the clutch point the engine speed begins to rise until it attains full speed.

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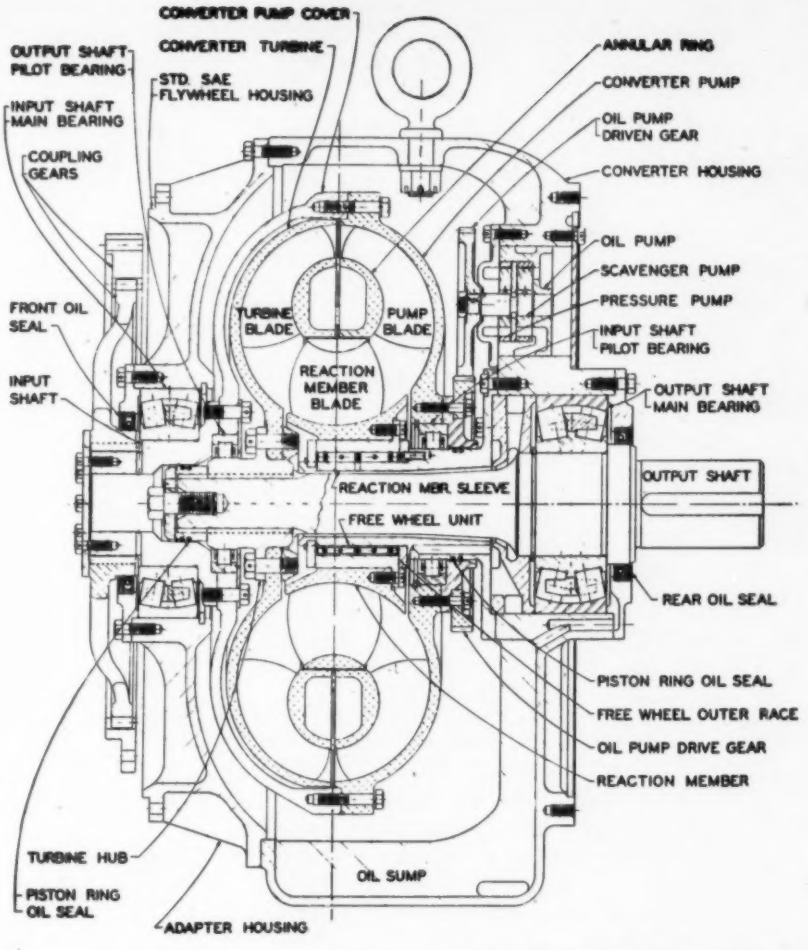
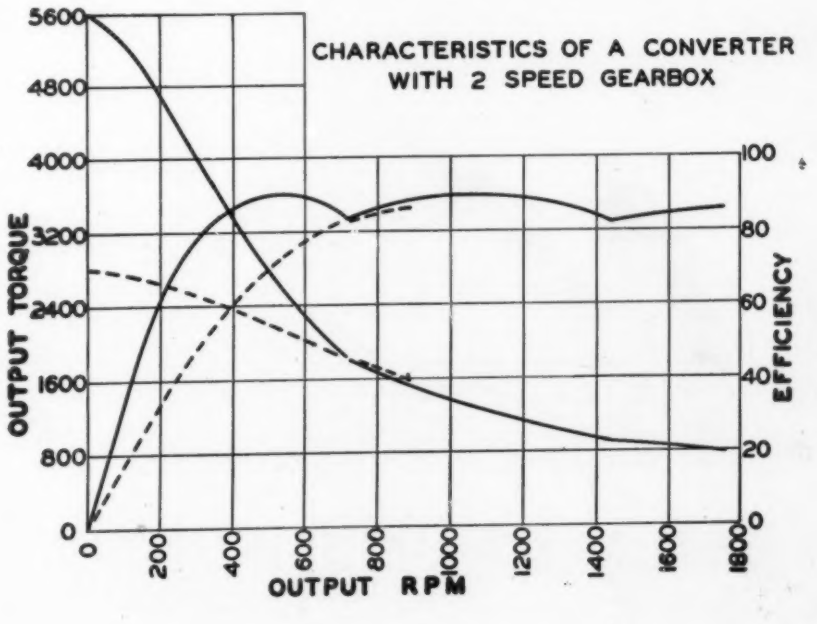


Fig. 6. A completely independent converter, as shown, is the most flexible and permits application of the unit to a wide range of prime movers.

Fig. 7. Characteristics of a converter with a two-speed gearbox.



AIR POWER SQUEEZES RUG CLEANING COST

The use of air cylinders to maintain constant pressure automatically on the rolls of a rug wringer has resulted in more efficient water removal, faster drying time, safer operation, increased capacity and lower overall cost.

CONTROL OF PRESSURE on the rolls of the rug wringer built by the Cleveland Rug Cleaning Machinery Company of Cleveland is a critical factor in the efficiency of these machines. For years the heavy springs that were used for this purpose had to be adjusted due to wear, fatigue and the thicknesses of various types of rugs. This was a slow job and called for considerable skill. About three years ago the manufacturer was persuaded to install air cylinders, largely on the assurance that the troublesome pressure adjustment problem could be eliminated. The first job proved so successful that every rug wringer built since by this company has been air cylinder equipped.

The rug wringer is a two-roll, single pass water extractor, motor driven through a double reduction gear (36:1 and 5:1). The rolls have cores of seamless tubing pipe and are covered with a $\frac{5}{8}$ in coat of a specially compounded synthetic rubber. The rolls have a finished diameter of 14 in OD and a length of 192 in. The rubber coating is center crowned $\frac{1}{8}$ in to extract water in an even sheet from the center of the rug to each end. With the double gear reduction the rolls are driven at approximately 6 rpm.

Approximately two inches of the circumference of the rolls are engaged during operation; the pressure on the rug being approximately 40 psi. This pres-

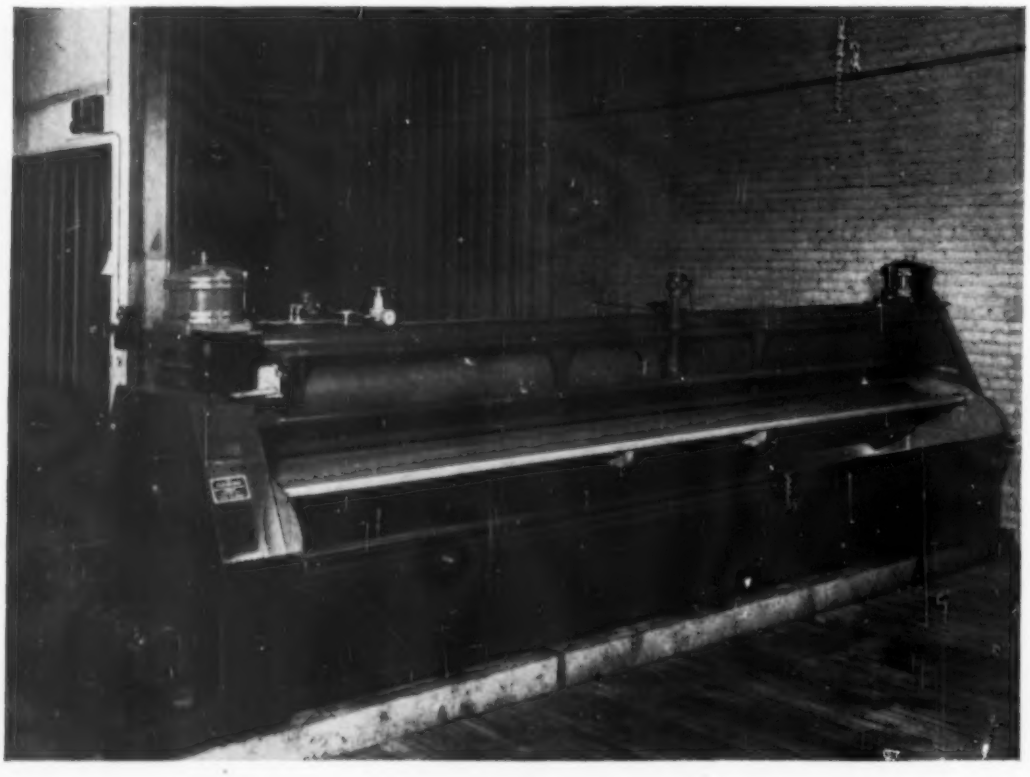


Fig. 1. The rug wringer set up in position to take advantage of its ability to deliver 40 rugs per hour to a drying loft.

sure is controlled automatically through two air cylinders, one mounted over each end of the rolls. A two-way handle operated valve is used to equalize the pressure at the ends of the rolls. Air is supplied by a ½ hp compressor through a pressure regulating valve.

With air control of the pressure on the rolls, correct pressure for the most efficient water extraction is applied at all times regardless of the thickness or type of rugs. Air controlled wringing has reduced the water content by 50 percent; this has meant a reduction in the subsequent drying time from six hours to four hours. This is an important advantage since it increases the daily capacity of the drying loft and makes one day service practical.

The rug wringer is used in a rug cleaning plant after the scrubbing and rinsing operations. The rug is placed, rolled, in a rinse trough under the front loading edge of the machine and left to soak for one minute. The machine is started and stopped by actuation of a toggle bar operated by hand grips on a bar which runs the length of the machine. The machine is started and the two man crew feed one edge of the rug into the rolls. A safety bar immediately in front of the rolls prevents fingers from moving into the rolls. A water line across the length of the loading board is fitted with nozzles which spray water in a lateral pattern to form a vertical wall of water across the surface of the rug as it moves into the rolls. The water spray is controlled manually by a valve mounted on the water line at the center of the rolls.

The average rug takes approximately 30 seconds to pass through the machine. The operators go to the back of the machine and pick up the emerging edge of the rug. It may or may not be necessary to stop the machine momentarily to do this. There is a reversing switch on the back of the machine at the drive end which, when depressed momentarily stops the rolls, and which, if kept depressed, reverses the movement of the rolls.

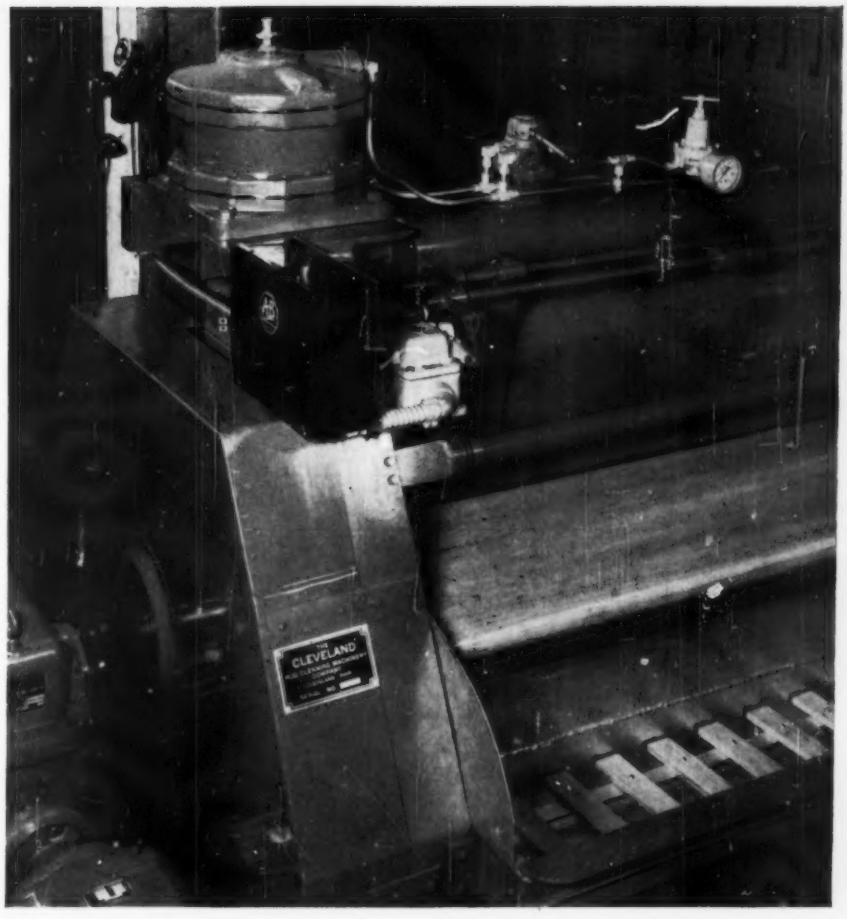


Fig. 2. The power end of the wringer showing the compact 10 in air cylinder, two-way valve, pressure regulator and hand-grip starting-stopping device. The loading board and rinse rack are also shown.

The procedure which follows may vary somewhat depending on the facilities or type of operation employed to get the rug from the machine to the drying loft. The operators may "walk" the rug away from the machine or roll it on the unloading shelf. In any event, the rug is moved by the most direct method possible into the drying loft where it is hung vertically. The drying is completed by circulating dry, hot air.

The capacity of the average rug cleaning plant is limited by the capacity of the drying loft. Most drying lofts in use have space for from 20 to 80 rugs. With the ability of the rug wringer to turn out a maximum of 40 rugs per hour, the drying lofts often form a bottle-neck in production. With the reduction in drying time possible with the air controlled pressure from 6 hours to 4 hours, it is possible for the average drying loft to practically double its daily output. The ability to give one day service is also an important advantage.

The basic design of the rug wringer has been virtually unchanged for 20 years. The air control for roll pressure is given credit for the improved performance and production record made by nearly 50 machines so equipped in the past three years. The advantages reported by operators include: (1) automatic roll pressure regulation; (2) greater water content removed; (3) increased daily capacity of drying lofts; (4) safer operation, especially with unskilled attendants; (5) ability to give better service; and (6) a reduced overall cost of the entire rug cleaning operation.

The First of a Series of Articles on Air Circuit Designs

AIR CIRCUITS FOR REMOTE CONTROL

AIR CIRCUITS are finding a steadily increasing number of applications throughout industry in the solution of control problems. Air circuits possess the advantages of simplicity, reliability and positiveness of action that are essential in control systems, particularly for remote control. The four air circuits illustrated cover a very wide range of applications.

By W. J. SCHUPNER
Design Engineer
Chicago, Ill.

The four-way solenoid air valve shown in all the circuits is a pilot operated balance spool type, i.e., the solenoid does not operate the valve spool directly but functions to release a small volume of air which acts as an intermediate fluid lever to actuate the spool movement. There are certain advantages to be gained from the use of this type, especially in large size valves because no holding current is required to keep the spool in position since there are no springs and no pressure to overcome. For this reason solenoids may be of small size and short stroke.

MANUAL PUSH BUTTON CONTROL

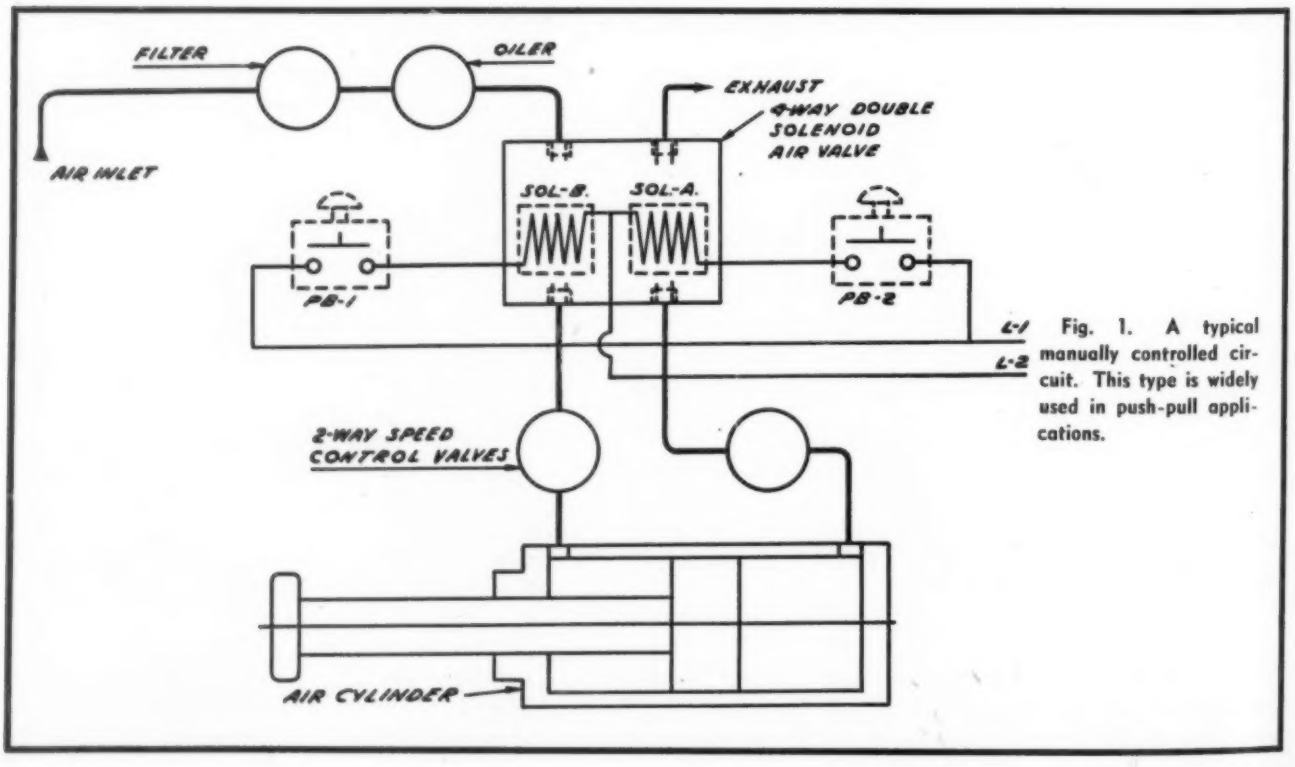


Fig. 1. A typical manually controlled circuit. This type is widely used in push-pull applications.

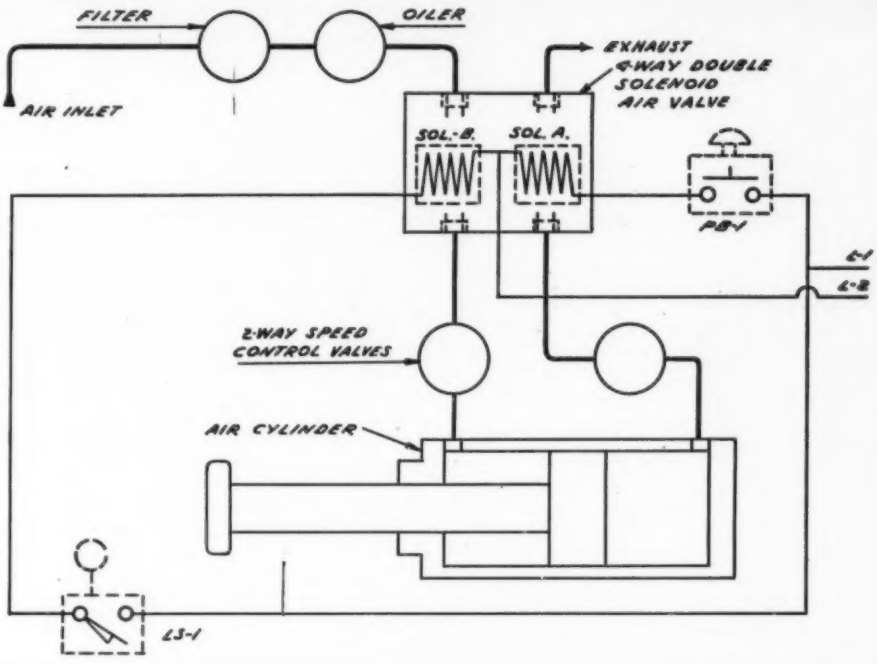


Fig. 2. A semi-automatic control circuit. This arrangement, incorporating a limit switch, is used for actuating many types of feed devices.

SEMI-AUTOMATIC CONTROL

Momentary contact limit switches and push buttons are the only controls required for most circuits, avoiding the need for holding contactors and relays. The exceptions, of course, are operating conditions which call for a definite time delay at one end of the cylinder stroke.

Each diagram shows an air filter or strainer and an oiler. These are considered necessary auxiliaries in modern air controls. Proper lubrication plays an important part in their performance. If a pressure reducing valve is required, it is usually located between the filter and the oiler. Operating pressures do not usually exceed 125 psi. Two-way speed control valves are used between the four-way valve and the cylinder permitting any piston stroke

AUTOMATIC RECIPROCATING CONTROL

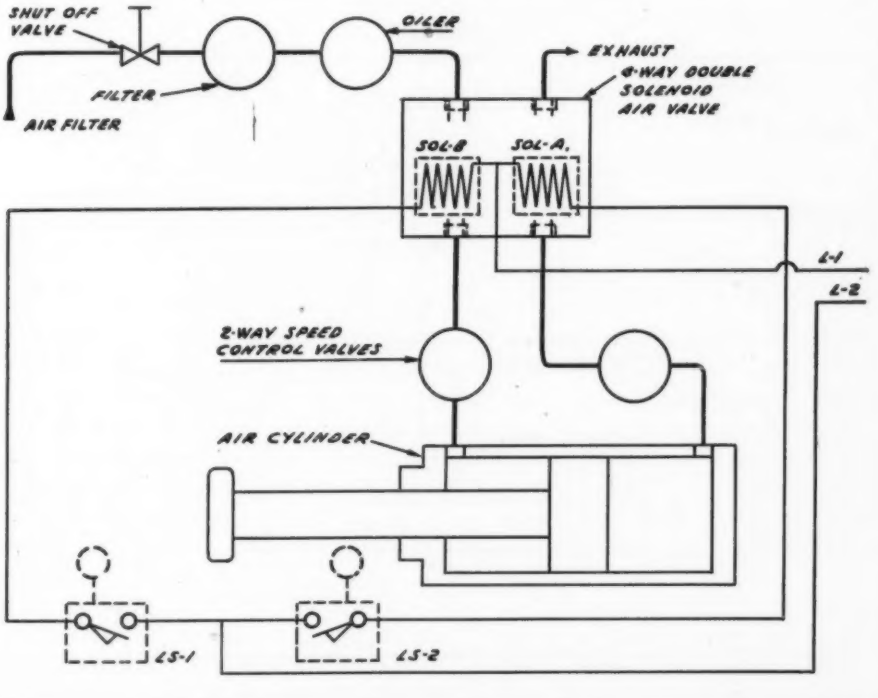


Fig. 3. An automatic or reciprocating circuit. A wide range of stroke flexibility is obtained by varying positions of the limit switches.

speed from zero to maximum. These speed control valves have free flow in one direction and controlled flow in the other; the controlled flow is usually away from the cylinder to obtain uniform velocity.

Manually Controlled Circuit

To operate this circuit (Figure 1) momentary contact push button PB-2 is pressed and released. Solenoid "A" is energized, directing air to the rear of the cylinder causing the piston to move toward the front end of the cyinder (left as shown on the diagram). To complete the circuit, the operator presses PB-1 and releases it. This energizes solenoid "B" and causes the piston to return to its original position. This type of remote control, is probably the most generally used in push-pull applications.

Semi-Automatic Control

To operate momentary contact, (Figure 2), push button PB-1 is pressed and released. Solenoid "A" is energized and the piston moves to the left. When the dog on the piston or operating table strikes the normally open limit switch LS-1, the piston will return immediately to the opposite end of the stroke. This arrangement is employed on many machines as a means of actuating feed mechanisms in press work and for moving products in timed conveyor systems. In this latter case, PB-1 may be a limit switch similar to LS-1 in which case it is operated by the conveyor.

Automatic Control

In an automatic or reciprocating circuit, (Figure 3), operation is similar to the semi-automatic control except that the piston will continue to reciprocate as long as air is supplied or the electric circuit is closed. Any part of the stroke may be used; the positions or spacing of the limit switches permits this flexibility. The rate of movement is controlled by speed control valve adjustments. Devices using this method of air control are numerous and varied.

Semi-Automatic Tonnage Control

In this circuit, (Figure 4), a normally open adjustable pressure switch PS-1 is connected to the line entering the rear cylinder port and close to it. When starting button PB-1 is pressed, the piston will start to move to the left. At this point, if PS-1 has been set to function at a low pressure, the load required to overcome the friction of the piston in starting may demand a higher pressure than that for which the switch has been set and it may close. However, it will be ineffective until the dog on the piston rod trips the maintained contact switch MCS-1, which cuts PS-1 into the circuit. Since PS-1 operates on a low differential, it has opened before MCS-1 has been reached. When the piston rod reaches the work, it will deliver a thrust equal to the pressure at which PS-1 has been set and it will return automatically since PS-1 now serves to energize solenoid "B" which reverses the four-way valve. As the piston returns, the dog on the rod opens MCS-1 and performs as before in the next cycle. Riveting machines, forming die presses and many types of work requiring controlled piston loading utilize this means with satisfactory results.

Footnote: The second article in this series will appear in an early issue.

SEMI-AUTOMATIC WITH TONNAGE CONTROL

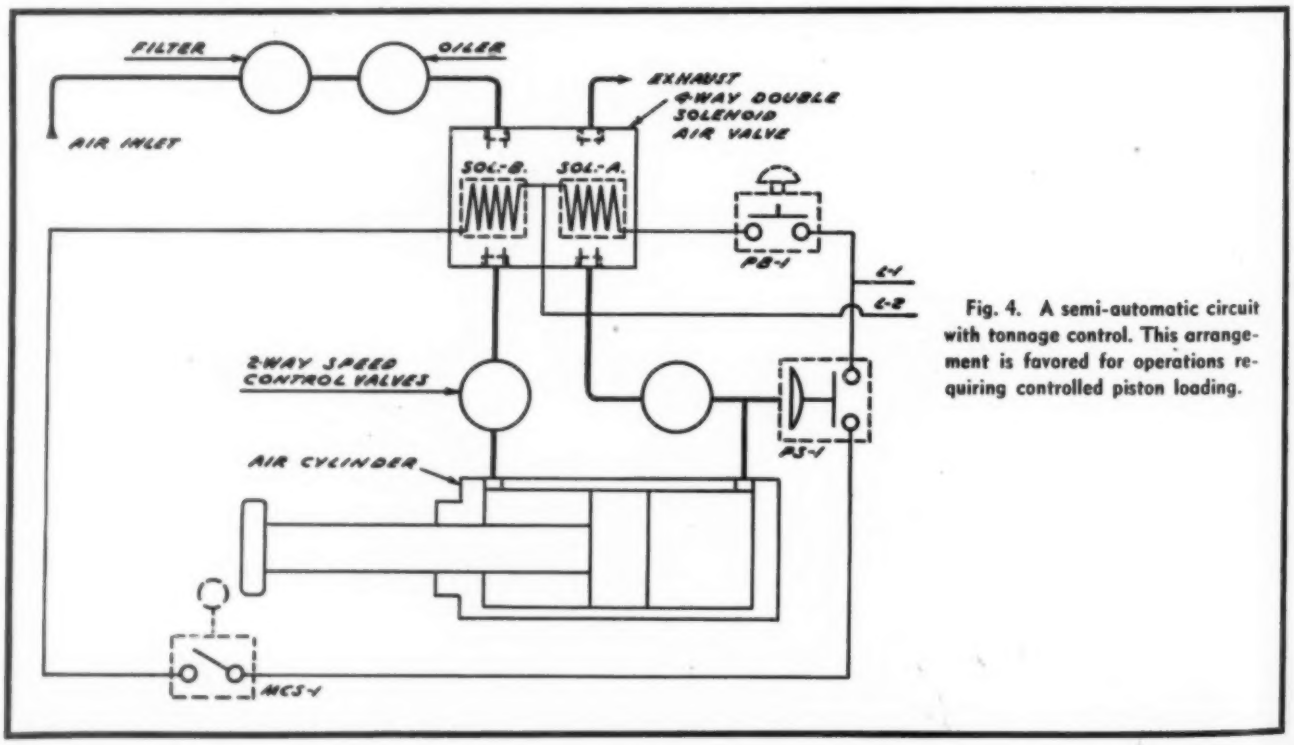


Fig. 4. A semi-automatic circuit with tonnage control. This arrangement is favored for operations requiring controlled piston loading.

Fig. 1. The setup of the hydraulic equipment on a standard coal dump truck.

FLUID POWER DELIVERS THE GOODS

The application of a hydraulic power system to a portable conveyor helped maintain heavy coal delivery schedules in severely unfavorable weather by providing positive starting, controlled belt speed under varying loads and infinitely variable speed control for accurate "spotting" in unloading.

By C. W. CHORMANSKI
General Manager,
Great Lakes Manufacturing Corp.,
Cleveland, Ohio

JUST PRIOR to World War II small portable truck conveyors made their appearance in the retail coal industry in this country as an aid in the delivery of coal. During the war years these conveyors kept many small coal companies in business by supplementing their depleted man power; the man hours saved ran into the millions. The majority of the portable conveyors were powered by a single cylinder air-cooled gas engine; occasionally they were driven by electric motors. Since these power sources had limitations, a number of manufacturers of this type of equipment began a search for some other source of power, particularly one that could utilize the truck motor itself. Naturally, one of the most attractive possibilities was hydraulic power. Much experimenting was done and several companies marketed conveyors utilizing that type of power.

Hydraulically powered portable conveyors are already past the experimental stage. One in particular, which we will describe, is the result of the cooperation between one of the pioneer users of hydraulic power in the portable truck conveyor field and a leading manufacturer of hydraulic pumps and valves.

The hydraulic system in the portable truck conveyor is shown schematically in the accompanying diagram, page 16.

The system consists of a pump, control valve and motor as its principal elements and a reservoir and transmission lines, the latter both tubing and flexible hose.

The gear type pump, of 3.25 cu in displacement, delivers 17 gpm at 1200 rpm and 1200 psi. The fact that only one power

take-off was available on the dump type truck, the installation presented a problem. The power take-off was used to drive the body hoist. A section was cut out of the hoist drive shaft and a double-end shaft pump was mounted on this line by means of two universal joints. The hoist dump pump is driven through the double-end pump. This installation has functioned very satisfactorily on this and on similar jobs.

An open center type of control valve was selected because of its flexibility. On this job it operates at 500 psi. The valve serves three purposes. First, it operates as an on-off valve. In the off position the open center design diverts the entire flow to the reservoir, the line resistance remaining as the only static resistance in the oil circuit. Second, the control valve operates as a speed control for the conveyor by shifting pump flow to the hydraulic motor as the load varies. This is an important advantage over internal combustion engine drives which slow under heavy loads and accelerate under light loads. Once a speed is selected and fixed by the valve adjustment handle, the same conveyor speed is also fixed regardless of extreme variations in loading. Again, it is desirable to vary the speed of a conveyor belt to give a definite unloading pattern which will vary with each unloading operation. The selection of any speed within the range of the equipment is made instantly at the touch of the valve handle.

Third, the control valve operates as a relief valve. A built-in relief valve, set for 1000 psi on this type of installations, opens to prevent damage if mishaps, e.g., the jamming of the conveyor belt, the stalling of the motor or the backing up of pressures occur.

The motor is a gear type, one cu in displacement hydraulic motor. It is compact, about the size of a man's fist and weighs less than three pounds. The shaft, with a two-jawed collar and locking pins, extends beyond the mounting flange; the pins interlock into slots on the mounting plate of the conveyor drive.

As the motor itself is plugged in to set up the conveyor for operation, there are no hose connections to be made or broken at any time. This arrangement is an assurance that no grime or abrasive dust gets into the hose fittings; this is of particular importance when handling such materials as coal. All working parts of the hydraulic system are entirely enclosed and protected.

When the motor is disconnected it is hung on a bracket provided for it under the back end of the body. Clips under the body between the motor bracket and the control valve are provided for hanging the hose. The length of the hose is determined by anticipating any possible maneuverability which might be demanded of it.

High pressure hose (1500 psi) of one inch diameter is used. Standard couplings and copper tubing complete the circuit. S.A.E. 10 oil has been used.

A Typical Installation

A typical installation is shown in Figure 1. The control valve is mounted on the body of the dump and is connected by flexible hose to a manifold block on the chassis of the truck. This was determined upon for both the convenience and the safety of the driver.

In a recent interview the superintendent of the retail yard for one of the large coal companies in a midwestern city had the following to say regarding his experience with this hydraulic conveyor:

"We have been using portable conveyors for years for loading and unloading coal and until last season, when we put a hydraulically powered conveyor in operation, we had come to expect a number of difficulties which added up to rather formidable proportions in severe weather. We now have had a season's experience with a hydraulic conveyor and believe that the unit has had as rugged

(Continued on Page 18)

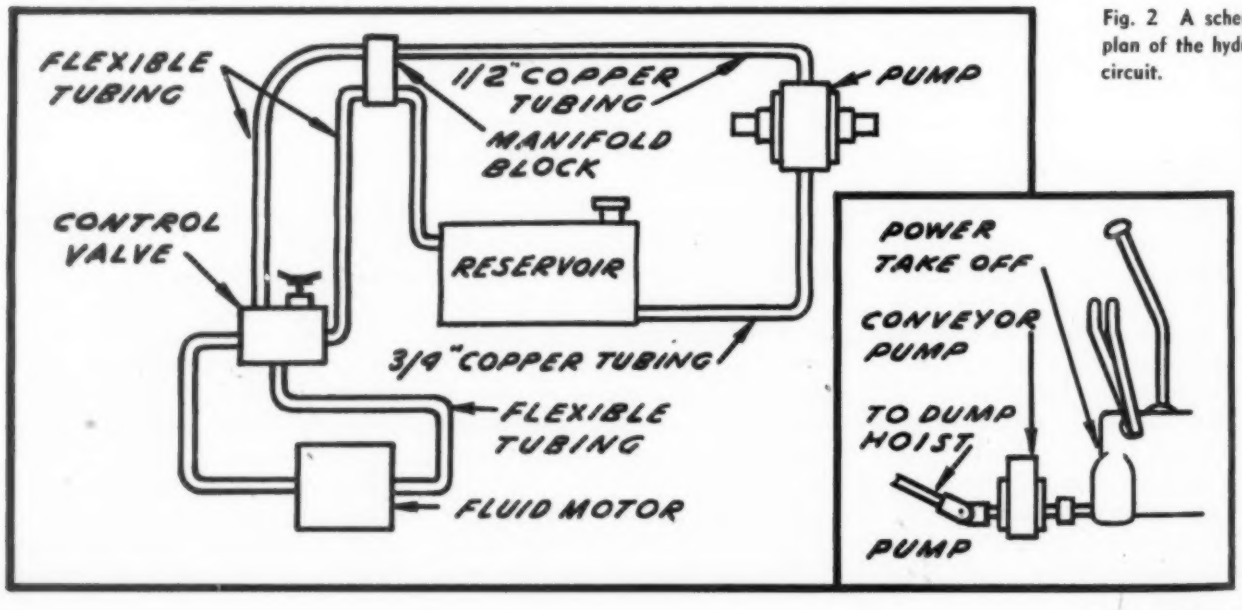
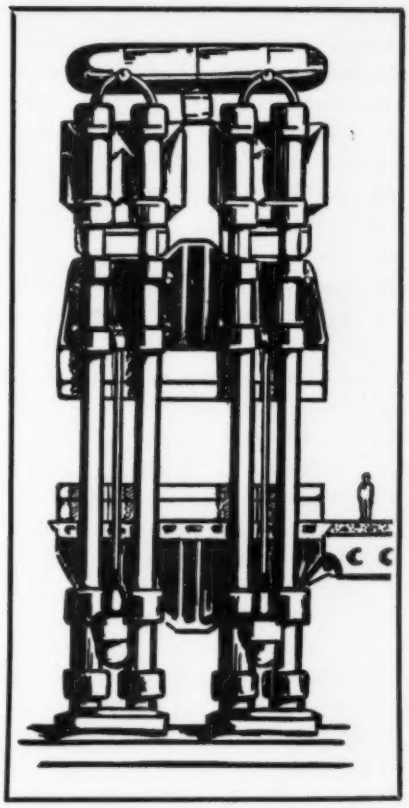


Fig. 2 A schematic plan of the hydraulic circuit.

Fig. 1. The 30,000 ton hydraulic forging press.



Hydraulic Colossus

The use of a giant hydraulic forging press to produce aircraft alloy parts lighter, stronger and to finished limits faster than possible by previous fabricating methods.

THE German aircraft industry used a 30,000 ton forging press of the air hydraulic type to form aluminum and magnesium aircraft parts to very accurate dimensions. This press—the largest hydraulic press ever used—was operated by the I. G. Farbenindustrie at their Bitterfeld plant from 1944-1945. The principal parts produced were propeller blades and engine mounts.

This huge forging press is a hydraulic die press type of design operated by high pressure water. The air accumulators are served by four hydraulic pumps each with a 600 hp motor. The press has eight main columns. (see Fig 1) Superimposed on each column is a master cylinder equipped for operation in three pressure stages (10,000, 20,000, and 30,000 ton total pressure) effected by two hydraulic booster stages. The lower platen and knock-out mechanism are hydraulically operated.

For forging propeller blades the initial cast ingot was extruded and cut to length. These pieces were heated to 860 F and eccentric rolled from the center of the piece, leaving a rough, double cone tapered shape. This shape was then reheated to 895 F and placed in the preheated lower die. The upper die was then closed, forming the finished double blade. After quenching the only finishing required was polishing. A maximum rate of 700 propeller blades per eight hour period was attained using double dies.

The general procedure for forging engine mounts and wing-spar caps was quite similar.

The standard German method for making tapered wing-spar caps was to parallel extrude a copper bearing alloy, cold stretch and machine. With forging a zinc bearing alloy could be used and the machining could be eliminated.

In the production of wing-spar caps, for example, the use of the press resulted in rather remarkable weight and time saving advantages. Where 1540 lb of steel were required by the old fabricated method (see Fig 2), only 275 lb of an aluminum alloy was needed for the forged spar cap. (see Fig 3) The estimated saving in manufacturing time was about 320 hours for the entire spar.

Previous to the construction of the 30,000 ton press, a 6,000 ton forge press was used to produce forgings for civilian use. Satisfactory results on this press led to the completion in 1938 of a 15,000 ton hydraulic press for producing aircraft forgings. After some experience with this press engineers were convinced that an even larger press developing extremely high

Fig. 2. Old spar-cap produced by fabricated method.

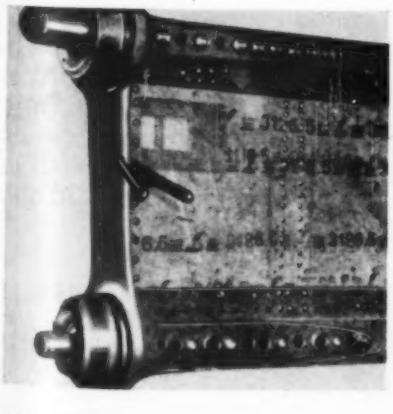
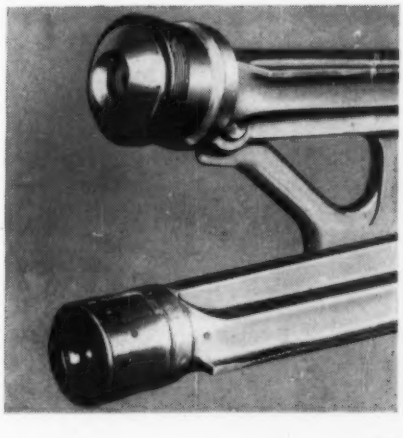


Fig. 3. New spar-cap produced by forging press.



Adaptation of article published in Technical Data Digest, Vol. 13, No. 4, Air Documents Division, Intelligence Department, Air Materiel Command, USAF.

pressures and working on larger areas could produce propeller blades within the limits of accuracy required. After some investigation construction was begun on the 30,000 ton press. It was put into operation in 1944 and continued in operation until May 1945.

FLUID POWER DELIVERS

(Continued from Page 16)

a test as it is likely to encounter in our type of service.

"Mid-winter is a peak delivery season for coal. The domestic load is always pyramided on the regular industrial and commercial delivery load at that time. Our equipment must be able to function in the coldest weather; it must be light enough for one man to handle easily; and its operation must be positive and certain. In addition, it is desirable that the belt speed be adjustable to permit accurate 'spotting' of the coal in unloading.

"A hydraulically powered conveyor was brought to our attention. Since the elimination of the troublesome starting problem was of major importance to us and we were assured that a desirable speed could be maintained under a variable load, it was decided that the unit would be given a thorough test.

"To date the conveyor has given us excellent service. The hydraulic system has functioned perfectly; there has been no maintenance problems during the season's operation.

"Our experience has convinced us that the hydraulically powered conveyor has some very definite advantages over equipment used previously. As we have found them:

(1) there is no starting problem. This is a real advantage in extreme weather, especially when we must meet a peak number of emergency calls;

(2) the conveyor belt speed is regulated more easily. Once a selected speed is set, the belt speed has been constant regardless of the irregular loads carried. We have been particularly pleased with the smoothness of operation;

(3) the flexibility of speed control has made 'spotting' delivery of coal a very simple matter. It is a common requirement that the first load or first part of a load be deposited some distance from the end of the conveyor, while the last load or the last part of a load be simply dropped over the end of the conveyor;

(4) the conveyor itself is lighter. This is an important advantage to a heavily clothed man who must lift the conveyor off and onto its carrying rack on the side of the truck;

(5) the hydraulic equipment is fully enclosed and there is no risk of getting coal dust or other foreign material into any working or moving parts."

It is clearly apparent that hydraulic power offers very definite advantages to the user of portable truck conveyors. With the starting problem eliminated, positive control of belt speeds, full protection of all parts, the hydraulic package power unit adds up, with systematic preventive maintenance, to a new standard of reliability, convenience and economy for operators of portable conveyors.

TORQUE CONVERTER

(Continued from Page 9)

The efficiency curve starts from zero and rises rather sharply, attaining 80 percent at 640 rpm output shaft speed and remaining above 80 percent throughout the speed range. The maximum efficiency during the converter range rises to almost 90 percent and drops to about 83 percent at the clutch point, rising again from there on. The output torque starts from a maximum of 2800 ft-lb and drops to about 900 ft-lb at the clutch point and then continues with the engine torque curve.

By means of the "K" curve, it is also possible to figure the converter performance at any part throttle. The dotted lines show the converter in half throttle. The engine speed, of course, is reduced. The most interesting part, however, is the shift in the efficiency curve. Higher efficiencies will be obtained at lower speeds and will be maintained up to the previous top speeds. In other words, this broadens the efficiency curve and also raises the maximum efficiency in the coupling range. This is of tremendous advantage on equipment where full throttle is used a small percentage of time. An example is found in power shovels where full throttle is used only during the lifting cycle.

The final selection must depend on the service for which a given combination is intended. In general, it is advisable to select a rather high stalling speed, since this will give a smaller converter and therefore a less expensive converter.

Factors in Converter Selection

The fundamental requirement is that the maximum torque requirements must be met. However, the maximum speed requirements must also be met. Another factor to consider is that the stalling speed should fall into the region of lowest specific fuel. As the engine speed remains practically constant throughout the converter range, the stalling speed gives a good indication of full throttle engine operating speed during this range. Inasmuch as the engine speed for stalling is almost the same as at the clutch point, the stalling speed also determines the point up to which torque-increase is available. This is another important factor; from this point of view it is desirable that the clutch point be at a high speed ratio. In selecting a converter for auto-

(Continued on Page 22)

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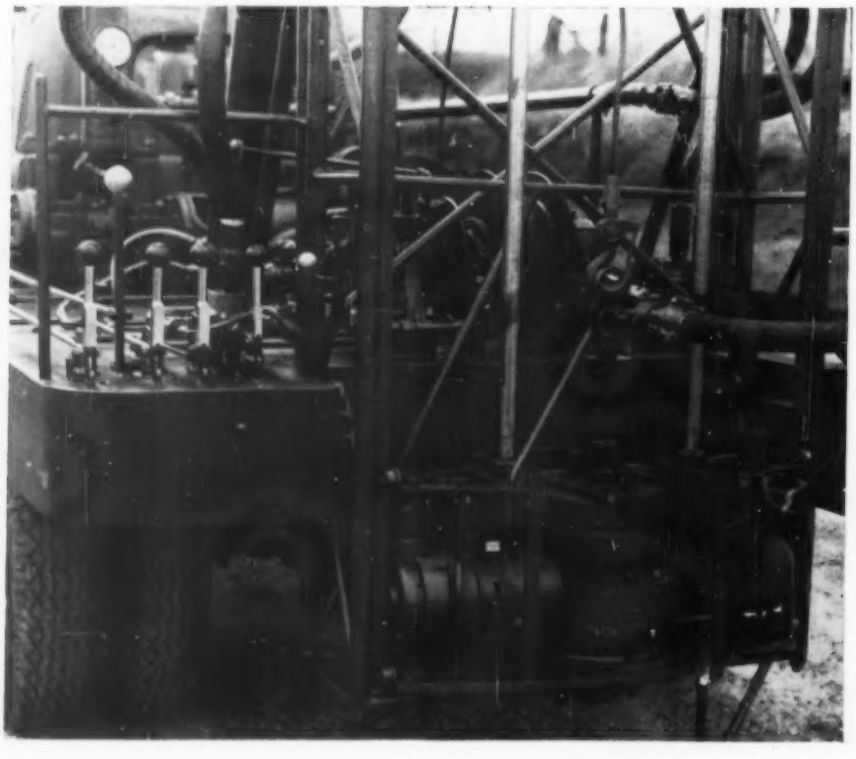
Fig. 1. The well drilling rig in travelling position.

EXPLORING FOR OIL AND WATER

The use of fluid motors for the operation of a portable drilling rig; one motor in each of three circuits to rotate tools and pipes, operate a winch, to lift the rotary table and to operate the mast.

Fig. 2. The rotary table with fluid motors. The hand controls for valves are nested conveniently for the operator.



A TRUCK MOUNTED drilling rig, equally useful for exploratory work in the oil fields and for drilling water wells, utilizing the high torque advantages of fluid motors in a 1000 psi constant delivery system, has been developed by the Bury Manufacturing Company of Princeton, Indiana. The three hydraulic circuits of the system were developed jointly by the company and by the Tec Engineering Corporation of Logansport, Indiana.

One circuit with a 5 gpm pump operates the mast-lift cylinder and the ten foot cylinders for lifting the rotary table; two circuits, each with a 40 gpm pump, operate the rotary tools and the winch. The rig is designed for drilling holes up to 500 feet deep at an average drilling speed of 5 to 10 feet per minute. Tool speeds vary from 100 to 300 rpm. Both speeds depend on the soil conditions encountered.

The 5 gpm pump is used for pushing the tool into the ground at the start of a drilling cycle. The mast-lift cylinder is used to elevate the mast at the beginning of operations and to restore the mast to its horizontal travelling position (Figure 1). Operation of both mast-lift cylinder and the rotary table lifting cylinders is by separate 4-way closed center valves (Figure 4). These are hand operated by extension linkages. The hand controls are grouped together at the left rear of the truck body, convenient for one man operation (Figure 2).

Two 40 gpm pumps drive the three fluid motors, which are constant displacement, dual vane, rotary type. One of the fluid motors is used to operate the winch; the other two are used for rotating the tools and pipes. Tools and pipes are flange mounted to a drive box on the rotary table and drive the tools through beveled and ring gears. In this application fluid motors must possess good stall torque characteristics, since the tool cannot be started in the ground unless the fluid motors start with their full torque.

The second 40 gpm pump can be used for rapid traverse of the rotary table upward as well as for the rotation of the fluid motors on the rotary table and winch. Fluid motors for the rotary table and for the winch are operated through 4-way open center valves, hand operated.

Check valves in both 40 gpm pump circuits permit the selection of the direction of flow of the oil without allowing the oil to back up to the valve.

The reservoir is a tank built into the body of the truck. Oil is delivered to the mast by hoses; tubular structural members of the mast serve a double purpose since they are also used as oil transmission lines.

The 1000 psi system is designed to withstand the jolting and shock incident to travel off-the-road to job sites.

The hydraulic system was chosen to fit the characteristics of the operation. Full starting torque was essential to start the tools under full load. The tandem pump arrangement simplified the power problem. The entire system is self-lubricating and all working parts are entirely enclosed. The circuits themselves (Figure 4) have been simplified for easy maintenance.

(Continued on Page 25)

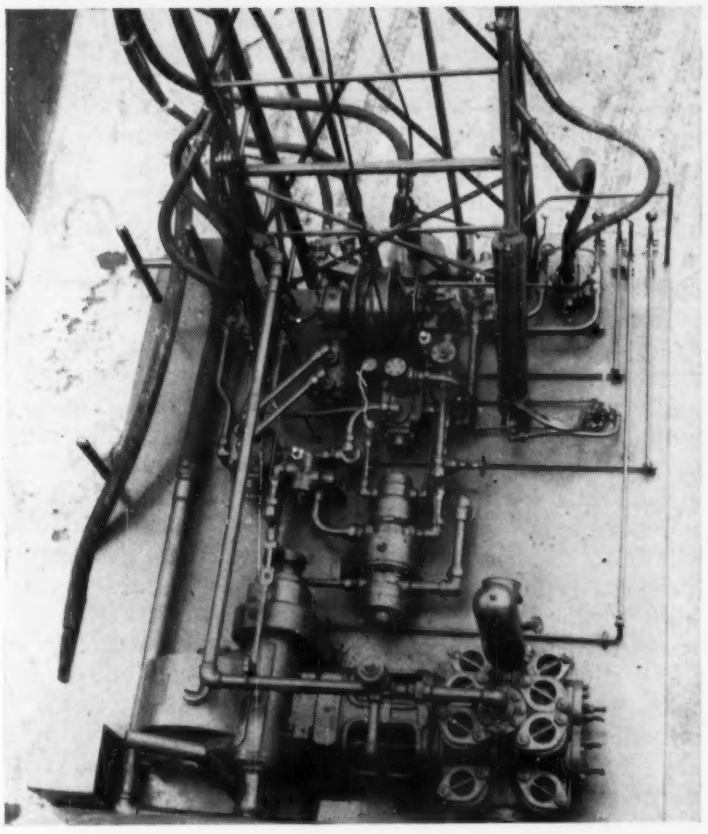
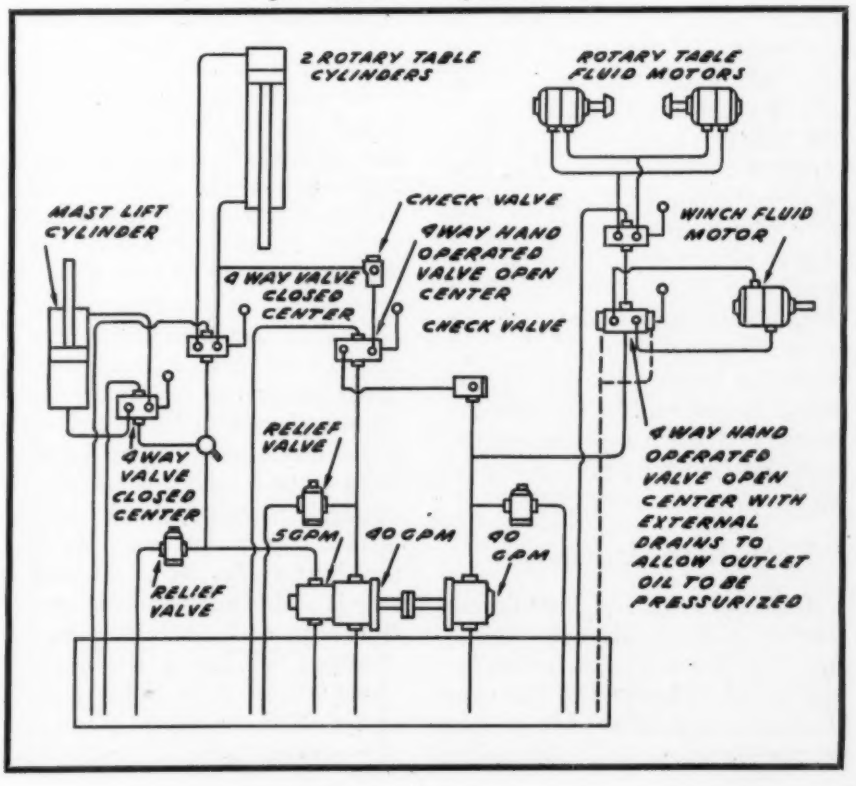


Fig. 3. A bird's-eye view of the drilling rig showing power plant, pumps, mast and mast lift cylinder, winch and winch motor.

Fig. 4. Schematic of hydraulic circuit.


2 ROTARY TABLE CYLINDERS
ROTARY TABLE FLUID MOTORS
MAST LIFT CYLINDER
CHECK VALVE
4 WAY HAND OPERATED VALVE OPEN CENTER
WINCH FLUID MOTOR
4 WAY VALVE CLOSED CENTER
CHECK VALVE
RELIEF VALVE
4 WAY VALVE CLOSED CENTER
4 WAY HAND OPERATED VALVE OPEN CENTER WITH EXTERNAL DRAINS TO ALLOW OUTLET OIL TO BE PRESSURIZED
5 GPM
40 GPM
40 GPM
RELIEF VALVE

TORQUE CONVEYOR SELECTION AND APPLICATION

(Continued from Page 18)

motive purposes, the stall speed is usually put at a speed about two-thirds of the maximum speed of the engine. This is done to prevent excessive engine speed when starting.

For other applications, as for example oil well machinery and shovels, where the engine is normally run at governed speed, the stall speed may be selected to be very close to this maximum speed, thus making the maximum horsepower available at all times. It is possible in many cases to replace a slow speed high torque engine by a high speed lower torque engine and use a converter in conjunction with the latter. Therefore, it is possible in some instances to save money on the original investment and to increase the work output of the machine. In some cases it may be possible to make additional savings by eliminating a two-speed transmission. This is an example of how a high priced transmission actually may save in initial cost and increase the output as well.

In the selection of a converter, maximum torque ratio alone is not a proper criterion for converter performance. What is important is the speed range over which the variable torque may be obtained and at what cost this can be done. It is conceivable that a certain job can be done better with a converter of a lower torque ratio but a higher clutch point than with a converter of initial higher torque ratio and a lower clutch point. However, in order to arrive at a proper judgment, the actual speeds and torques in conjunction with a specific engine must be figured out and evaluated.

Converter Mountings

Converters can be installed in various ways behind the prime mover. The least expensive installation is to mount the converter pump directly to the engine flywheel as illustrated in Figure 4. If the converter is engineered for a specific application, this is the least costly method. However, arrangement must be made so that the hydraulic thrust forces developed by the converter proper will be taken in the engine thrust bearings.

If it is desired to retain all thrust forces in the converter proper instead of transmitting them to the engine thrust bearings, the simples application will be to add a converter pump cover and transmit the power from the engine to the converter by means of slidable splined connections as shown in Figure 5.

In building a converter which has to fit various makes of prime movers, a further step is taken. The front end of the converter is completely closed by the converter housing which contains bearings for the front end of the converter. The converter itself is a completely independent unit. The unit can then be applied to any engine or may be driven by a propeller shaft or sprocket and chain. See Figure 6. This is, of course, the most flexible arrangement and allows applications of the same converter in various fields and on various engines.

Converters with Two-Speed Gear Ratios

As mentioned previously, the initial torque requirements and the maximum speed requirements are major considerations in the selection of a torque converter. Inasmuch as maximum torque ratio of a converter is somewhat limited, it is conceivable that the maximum available torque ratio is not sufficient for a particular application. It would of course be possible to build converters which have a high torque multiplication. In general, however, this is accompanied by a lowering of the maximum efficiency. If it is desired to have a high torque ratio, the shape of the efficiency curve changes, giving a usable efficiency over a very low speed range. This might be adaptable for certain types of industrial applications. In general, however, this type of converter would not find a broad range of applications. It is therefore becoming an accepted practice to use a converter of comparatively high efficiencies with a very flat efficiency curve, and rather sacrifice some initial torque ratio and use gear reductions in back of the converter to make up for the lack of hydraulic conversion ratio.

Figure 7 shows the characteristics of a converter with a two-speed gear box. The low ratio has been selected to be 2:1. It will be seen that the high efficiencies are now obtained at very low speeds and at the same time twice the torque is available. Within each gear ratio we now have a completely automatic transmission with infinitely variable speed and torque.

It will be noted that the maximum output torque available from the hydraulic transmission is considerably higher than on the mechanical transmission. This indicates that a hydraulic transmission has a much better starting torque on grades and, of course, it will start much more smoothly. In spite of this high starting torque there are a few positions in the output torque of a converter where the torque will be less than with a comparable mechanical transmission. Such positions occur at the points where the engine speed comes close to maximum speed in each gear ratio. This, however, is offset by the smoothness and gradual variation in torque ratio available from the hydraulic transmission. It shows up as a disadvantage only for constant speed applications in these particular speeds.

In conclusion, it is evident that great strides have been made in the development of torque converters. Today we are entering the real development period. Opportunities appear infinite. There is no reason to doubt that hydraulic torque converters will, in the next few years, assume an important place in power transmission applications throughout industry.

ABSORPTION TOWER PRESSURE CONTROL

By JOSEPH H. GEPFERT,
Division Manager,
Reeves Pulley Company
Cleveland, Ohio

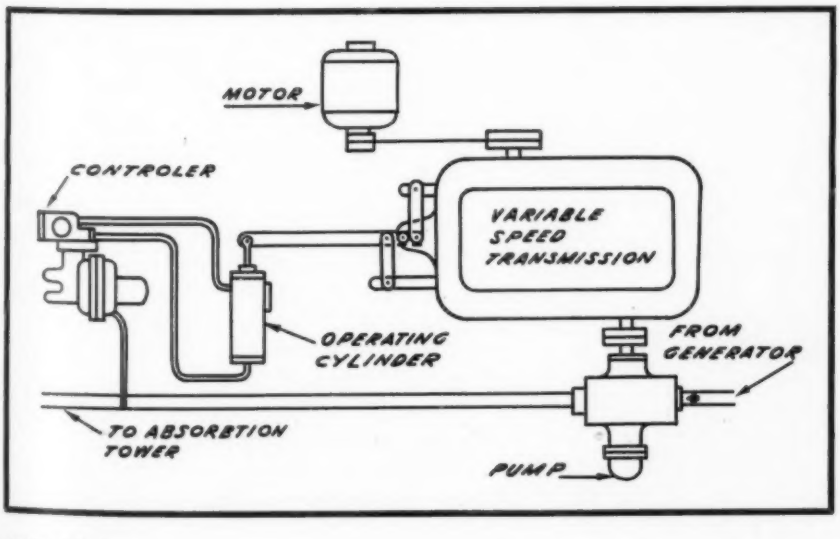
THE CHEMICAL industry has found that an absorption tower operates at maximum efficiency only when the fluid being delivered to the tower is at a constant pressure.

The production of a fluid in the generator is often quite erratic and, for this reason, it is usually necessary to insert a pump in the delivery line from the generator to the absorption tower in order to maintain pressure. Since both the absorption tower and the gas generator have variables in their operation, it is necessary for the pump to operate at a variable delivery rate in order to maintain a constant pressure at the absorption tower.

A simple system for accomplishing this objective is shown in the schematic diagram. The system is completely automatic and compensates for variations in delivery pressure of the pump at the tower, regardless of how these variations are introduced. An index of the pressure in the operation of the tower is taken by means of a standard pressure regulator controller which directly operates a 12 in power cylinder. It should be observed that both these pieces of equipment are off the shelf; there is nothing special about their design or construction.

The power cylinder is connected through a linkage to the operating lever of an infinitely variable speed transmission, which drives a gas pump in the fluid system. A standard constant speed motor drives the input shaft of the variable speed transmission, and the output shaft speed is set automatically by the controller, directly positioning the speed control lever of the variable speed transmission.

The entire system is assembled as a package drive assembly and has a minimum of control equipment to accomplish the desired results. The entire system is practically maintenance-free, since there is no delicate control elements required to maintain the automatic control. At the same time, control is extremely accurate, since the pump speed can be set at any value required to compensate for the differences in pressure shown by the regulator.



EXPLORING FOR OIL AND WATER

(Continued from Page 21)

For oil work, particularly for shot hole work, three men constitute a working crew. Three men can set up the equipment in 15 to 20 minutes. For drilling water holes two men can operate the equipment.

The rig has been in operation for approximately a year and a half with most of the experience in the oil fields of Oklahoma and Texas.

Ambient temperature influence has been practically nil. The circuits have operated efficiently with a light oil at working temperatures well over 100 F.

The Bury Manufacturing Company previously made mechanical rigs. Their interest in hydraulic operation was two fold: (1) speed of setup and operation; (2) the elimination of mechanical wearing parts to simplify maintenance and reduce wear-and-tear on the entire equipment. Their experience has been that the initial cost of the hydraulically powered equipment was in line with that of the mechanical setup; that the major advantage has been in speed of setup and operation and in reduction of maintenance cost.

The design of the hydraulic rig has resulted in a simplification of operation and of maintenance; it has given the equipment much better resistance to heavy off-the-road shocks; it has given high torque per dollar invested; and it has given safe, efficient service under all weather and atmospheric conditions.

Applied HYDRAULICS DIGEST

Abstracts, summaries and listing of articles on hydraulic and associated applications in industry; reports on prepared papers, talks and discussions of special interest to the hydraulics field.

What the User Should Know About Tubing

E. J. DeWitt, *Machinery,* v 54, February 1948, pp 165-169.

Part 1 of two installments. Tubing is divided into two general types—tubing with seams or welds and tubing without seams or welds. Each type is subdivided into three classifications—pipe, mechanical tubing and pressure tubing. Alloy tubing and "oil country goods" are given as further divisions. The four generally used methods of manufacture of welded pipe—lap welding, gas welding, electric resistance welding and continuous butt welding—are described in turn. One of the several processes used for making seamless pipe and tubing is described in some detail. The new "stretch rolling" technique is briefly outlined. An excellent choice of photographs and drawings add to the value of the text.

Four Automatic Transmissions and How They Work

L. H. Nagler, *SAE Journal,* v 56, March 1948, pp 36-39.

Based on a paper "Transmissions That Shift for Themselves", given at the SAE Metropolitan Section, New York, January 21, 1948.

An analysis of four major types of automatic transmissions: the Hudson Drive Master (syncromesh transmission with vacuum cylinders to operate the clutch and the shift lever); the Chrysler Fluid Drive (fluid coupling with conventional foot clutch and four-speed two-range gear box); General Motors' Hydra-Matic (fluid coupling with two sets of planetary gears in series, hydraulic control); and the Buick Dynaflow (a torque converter, the first in a stock American car, provides automatically variable drive ratio without using gears or clutch). The point of view of possible acceptance on the part of the motor buying public is developed. A discussion of comparable costs summarizes the facts that automatic transmissions cost more than conventional syncromesh transmissions, are efficient and gaining in acceptance but use more fuel throughout the life of the car.

Rotary Valve Controlled Pneumatic Hammer

Anonymous, *Product Engineering* v 18, November 1947, pp 94-95.

The cycle of operation of a rotary valve for the control of the pneumatic hammer made by Erie Foundry Co., is shown by an elevation drawing and eight detail sketches, one of each position in the operating cycle.

Hydraulic Drives in the Oil Fields

Nicholas A. D'Arcy, Jr. From a paper delivered before the Petroleum Division, American Institute of Mining and Metallurgical Engineers, Los Angeles, Calif.

Hydraulic drives are divided and discussed as three groups. The characteristics, applications and limitations of hydraulic couplings and torque converters are discussed and classified together as hydro-kinetic drives. Positive displacement fluid pumps and motors are similarly treated as the third group. This last group is the hydro-static type of drive. There are excellent statements of the basic principles of the hydro-kinetic and the hydro-static types of drives.

Hydraulic drives have been used successfully in every phase of the oil industry from geophysical drill rigs to refinery operations and new uses are constantly being developed for the proper hydraulic installations.

Two-Pressure Aircraft Hydraulic System

T. C. Hill and **E. G. Riley,** *Machine Design,* v 20, February 1948, pp 123-128.

A detailed functional description of the two-pressure hydraulic system for the Martin 202, consisting of a 1500 psi closed-center circuit used to operate nose-wheel steering, brakes and windshield wipers and a 3000 psi open-center circuit used to operate landing gear and wing flaps. The divided system was selected after the factors of weight, reliability and external leakage were studied. With four pumping systems available, the greater experience with the 1500 psi closed-center system and the lack of stored pressure to operate essential units in the event of failure of the pumping system determined that a combination of systems was necessary. The problem of operation of the combined system was solved by the hydraulics equipment manufacturer who cooperated on the design. The requirement was to maintain a continuous open-center flow through the 3000 psi circuit and at the same time auto-

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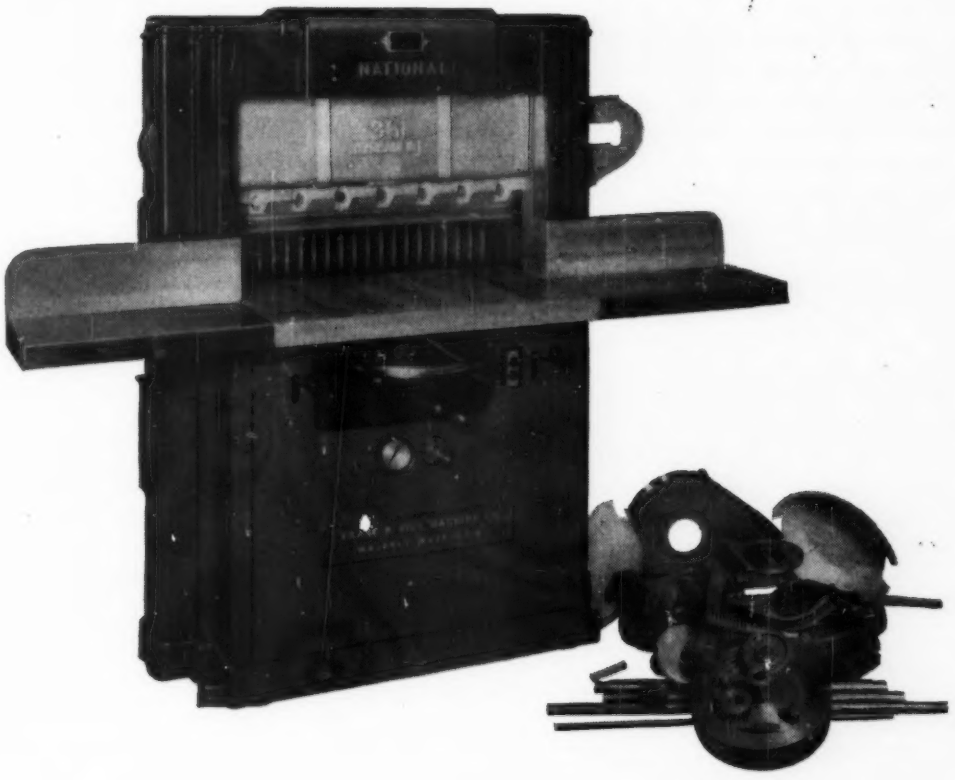

...in this hydraulic National paper cutter

MANUFACTURED BY FRANK M. HILL MACHINE CO., WALPOLE, MASS.

In this newly-designed Hill machine, both the paper clamping operation and the stroke of the knife are actuated by GEROTOR hydraulic cylinders. Most significant is the pile of nearly 100 parts shown at right . . . all eliminated in the change from mechanical to hydraulic operation.

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matically maintain a margin of 1250 to 1500 psi in the closed-center circuit. This was accomplished by the combination of a modified 3000 psi unloading valve and a pressure reducing valve. The modified unloading valve reduced the unloading range of 1250 psi cut-in and 1500 psi cut-out. A separate pilot pressure line from the accumulator is used to produce the cut-in and cut-out signals in lieu of the normal pressure feed-back through the accumulator port. The pressure reducing valve is mounted in the accumulator line adjacent to the unloading valve and is set to reduce from 3000 psi to 1700 psi.

The closed-center 1500 psi circuit has priority over the high-pressure open-center circuit at all times due to the unloading valve and pressure reducing valve action, which directs flow to this system at any time the pressure drops below 1250 psi. This insures that windshield wipers will not be slowed up due to lowering flaps and landing gear during the approach. It also insures against loss or impairment of brakes, wipers and steering while taxiing due to raising or lowering flaps. If the pressure to operate flaps on the ground is less than 1250 psi and the closed-center system drops to this pressure, the unloading valve will momentarily cut in and stall the flaps until the closed-center pressure builds up to 1500 psi. The unloading valve will cut out at this point and flap operation will be resumed. Since the pressures required for flap and landing gear operation will be above 1250 psi in flight, the closed-center system will be maintained fully charged automatically.

A detailed description of the landing gear operation and of the nose-wheel steering is given. A complete diagram of the two-pressure system and a number of details of circuit operation are also given.

A small electric motor-driven pump is provided for emergency operation of the hydraulic system in case of failure of the main engine-driven pumps. An emergency by-pass valve, mounted on the floor convenient to the pilot, is normally closed and opened only if the open-center flow becomes blocked due to misfunction of the unloading valve, landing gear valve or flap valve. Such a stoppage would cause continuous 3000 psi flow over the main relief valves and would result in overheating of the hydraulic fluid.

Formulation of Hydraulics Code

Seward N. Lawson, *Production Engineering and Management,* v 21, February 1948, pp 77, 79.

The tentative "Hydraulic Standards of Industrial Equipment" is reported in preparation by a committee of General Motors engineers and the representatives of a number of hydraulic equipment manufacturers. The work has been broken down for discussion into the following general headings: Pumps, Valves, Hydraulic Controls, General Circuit Diagrams, Piping and Manifolding for Power Controls, Oil Reservoirs, Heat Exchangers, Accessories and Devices and Safety. A number of symbols for designation of elements on diagrams has been prepared. Altogether the committee work, which is expected to continue for some months, will provide detailed specifications for the application of hydraulic equipment wherever used in industry and will promote safety of personnel, production and machine life.

High-Pressure Pneumatics

Anonymous, *Aeroplane,* November 21, 1947, pp 685-686.

Operation of various items of aircraft equipment have reached a high standard of efficiency with the use of compressed air devices. By using the turbine compressor to supercharge the pneumatic system, a 1000 psi system has been produced.

The Hymatic Compressor working at 1500 rpm draws 10.5 cfm of air from the turbine engine at a pressure of 50 psi. Advantages of supercharging the compressor include less work to compress the air, less heat dissipation, greater volume of air handled and low-delivery temperatures with the use of a precooler. A separator is incorporated in the system which enables collected oil and water to be drained off for inspection.

Hydraulic-Electric System

Walter E. Bock, *Machine Design,* v 19, December 1947, pp 107-111.

A description of the Automatic Magnaflux inspection machine which utilizes the magnetic-particle method for disclosing discontinuities by manual inspection. The machine was designed for the inspection of crankshafts and camshafts. The conveyor, which operated intermittently, since it had to provide periods of rest for the successive loading, magnetizing, inspection, demagnetization and rinse-unloading stations, is hydraulically powered by a drive cylinder which advances the conveyor one station by its forward movement.

Two sets of lifting and clamping cylinders are used to swing the circular or contact heads into position for particle spraying and the clamping cylinders, by moving forward, securely hold the parts. A duplicate set of control valves are provided. The drive cylinder operation is controlled through valves in the same system. The speed of outward and return strokes of the drive cylinder piston are easily adjusted to the timing cycle of operation of the machine. This eliminated the need of a manual change of gears or of a variable speed mechanism, clutch or brake for proper timing.

Complications were encountered in adapting the machine for circular or longitudinal magnetization which could have been solved by the addition of duplicate electrical equipment. This was dis-

garded as excessive in cost and undesirable because of the space it would occupy. The final answer determined upon was the addition of two limit switches, two relays, two pneumatic timers and two large magnetic contactors. A safety limit switch, at the unloading station, automatically stops the hydraulic pump motor, if the part at that station is not removed before the conveyor advance begins.

All controls are interrelated so that the steps in the operating cycle are definite and fixed. The failure of any step stops the entire machine. An electric "brain" in the control circuit automatically picks up the cycle after a stoppage.

Dial Feeds Synchronized by Air

Joseph F. Budnick, *American Machinist,* v 91, November 6, 1947, pp 101-103.

Indexing by means of a reciprocating action of a gib-restrained slide which is moved through a cushioned spring by the ram of a double-acting air cylinder is described and diagrammed. Various applications to control chute, tubular hopper and vertical feeds are outlined and illustrated.

Tool Standardization Program at GM

Walter G. Patton, *The Iron Age,* v 161, March 11, 1948, pp 131-135.

The working method of the Master Mechanics Committee, one of the GM operating committees under the direct supervision of the General Motors Production Engineering Section, in the study and evaluation of new tools, methods and operations is outlined. This method is of interest because the same procedure is being followed by the Production Engineering Section in developing hydraulic standards for industrial equipment.

Air-Powered Devices

Rupert LeGrand, *American Machinist,* v 92, March 25, 1948, pp 88-91.

Some of the methods used in incorporating air actuated devices to standard machine tools in order to increase production and reduce worker fatigue, are illustrated in this article. Some of the examples are: air powered drill feeds combined with commercial drill heads to form multiple spindle units; improved spot welder control by incorporating a foot controlled air valve; smoother air feeds with hydraulic resistance cylinders. Other examples show the value of air clamping and how it is possible for operator to utilize free time during the automatic cycle. Steps can be taken, as illustrated in this article, to provide low-cost, special-purpose machines by utilizing commercial pneumatic power units and standard machines. Increased production and better working conditions can result.

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for any fluid 10 to 4000 p.s.i.

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For maintaining an accurate, uniform rate of flow regardless of variations in pressure of **hydraulic fluid** or **water, gasoline** and other **petroleum products,** coolants.

To control speed of **lift trucks, hydraulic motors, actuating cylinders.**

To maintain flow rate for proportioning of different fluids.

WATERMAN ENGINEERING Company

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new HYDTROL switch controls pressures to 5,000 P.S.I.

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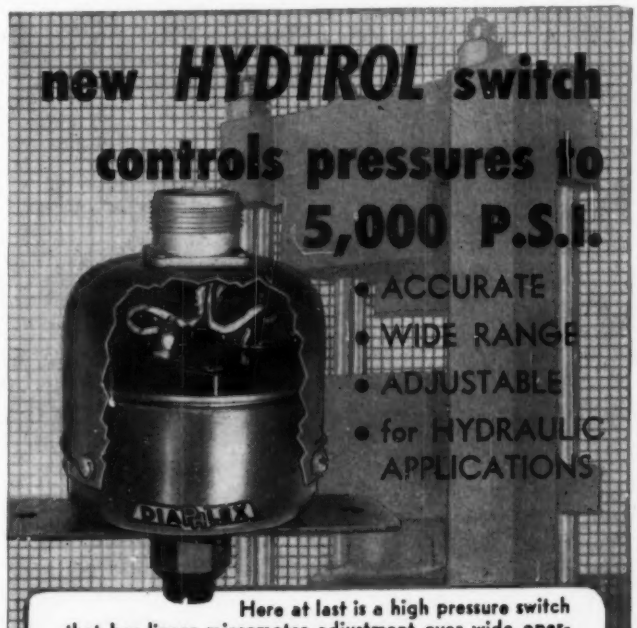


Here at last is a high pressure switch that has linear micrometer adjustment over wide operating ranges from 50 to 5000 P.S.I. . . has an adjustable differential of from 5 to 50% . . . whose hydraulically-formed tempered steel actuating diaphragm can be made to withstand 15,000 lbs. bursting pressure . . . and which finds high pressure hydraulic control uses from aircraft landing gear to heavy presses.

It's the new DIAPHLEX "HYDTROL" and we shall be glad to supply full information on request for Bulletin DH-3.

division of
DIAPHLEX COOK ELECTRIC COMPANY
Chicago 14, Illinois

Useful Literature

The publications listed are available without charge. Mark the initial key number on the card bound in this issue and mail.

25. Air Cylinders . . . A four-page release covering the cushion type air cylinders produced by Modernair Corporation. These cylinders are now available for air and low pressure hydraulic applications to 250 psi. They range up to 6 in diameter and can be obtained in 7 different mounting arrangements. Detail drawings, data and photographs are included. Accessory equipment for use with these cylinders is also available from this corporation. They include 4-way valves, 3 and 4-way series valves, automatic filters and non-cushioned cylinders.

26. High Pressure Pumps . . . Inverted, vertical triplex, high pressure pumps are featured by The Aldrich Pump Company in their data sheet 66. These pumps can be used for central hydraulic or high pressure applications from oil field to factory. Sizes ranging from 2 to 8 in stroke, develop pressures as high as 9000 psi. Special pumps for higher pressures are available. Schematic and exploded drawings, charts and illustrations are included in this bulletin.

27. Cycle Timer . . . A 4-page booklet, presenting the cycle timer produced by The Sinclair-Collins Valve Co., is available. The controller is electrically operated on 110 volts and is built with 4, 6, 8 or 10 stations. Sizes ranging from ¾ in to 6 in can be used on as high as 3000 psi service. Construction drawings show design of valves. Other valves produced by this company are also shown.

28. Oil Pumps . . . A 32-page brochure, prepared by the Imo Pump Division, De Laval Steam Turbine Company, contains various charts and conversion factors in addition to general information on the rotary displacement pumps produced by this company. Design drawings and photographs cover 3 series of pumps and show some typical installations. Convenient to use conversion tables and pressure loss charts for pipe sizes to 14 in are included.

29. Filters . . . A 32-page brochure, entitled "Quick Facts", has been prepared by the Cuno Engineering Corporation. It reviews two types of filters and presents case histories of typical installations.

30. Hydraulic Equipment Catalog . . . The complete line of hydraulic pumps, valves, motors, power control units and cylinders are reviewed in a general catalog prepared by the LaPlant-Choate Manufacturing Co., Inc. The compact power control units, consisting of rotary gear-type pump, 3-position control valve, adjustable relief valve and reservoir with internal filter, are available in four sizes from 15 to 60 gpm capacity. Cylinders are available in sizes of 4, 5 and 6 in diam for double acting applications. The rotary gear-type pumps are flange mounted and available in 25, 40, and 60 gpm capacity. Fluid motors cover the same range as the pumps with an additional 15 gpm unit. The valve shown is of the 4-way, 3-position type for service to 1000 psi.

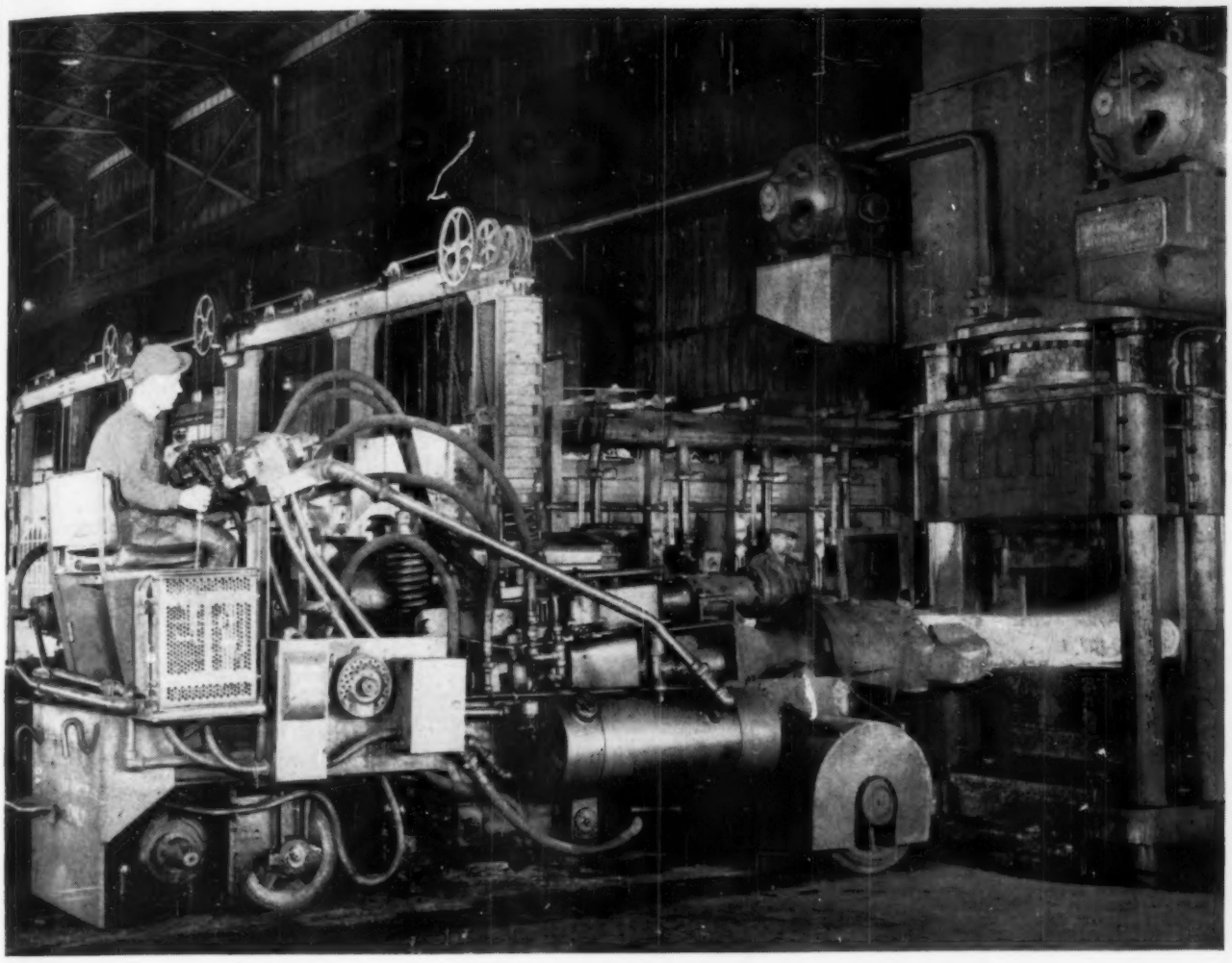
31. Solenoid Valves . . . The Automatic Switch Co., in their general catalog on solenoid operated valves, present their complete line for air and liquid service. Of interest are sections on safety shut-off and trip valves, 3-way pilot valves, external pilot controlled valves, 4-way pilot valves and strainers and filters for air service. Service pressures range as high as 300 psi and pipe sizes, depending on type of valve up to 3 in. Special trip valves and external pilot controlled valves for 6 and 12 in pipe lines are also included.

32. Engineering Service . . . A descriptive 22-page catalog covering the services offered by the Design Service Co. is available. It breaks down this company's national consultant coverage into the work of its individual offices in a number of industrial cities. Representative case histories are cited to illustrate the scope of services performed.

33. Hydraulic Equipment . . . A new industrial hydraulic brochure, entitled "Engineered Hydraulics", has been prepared by the Adel Precision Products Corp. Pumps and control valves are shown in detail and cylinders, power packs and relief valves are included. The pumps are gear type, constant volume units available in capacities from 1.5 to 60 gpm for 1000 psi service. Special pump models for automotive use and tractor power take-off shaft adaption units are also available. Hydraulic control valves shown are designed for 1000 psi service at capacities to 32 gpm. Four-way selector valves are available for pipe lines from ¼ to 1 in size; multiple stacking valves are available for ¼ and ¾, and for 1 in pipe sizes. Design drawings and specifications for all pumps and valves are included. The advantages of hydraulic applications to industry are treated briefly.

34. Air Cylinders . . . The Tomkins-Johnson Co. reviews its line of air cylinders for industrial applications in catalog 43. Non-rotating cushioned and non-cushioned cylinders are

(Continued on Page 32)



The manipulator serving a 1000 ton forging press at The Timken Roller Bearing Co.

Hydraulic Circuits Ease Forging

THE development of an inexpensive machine to charge small melting and heating furnaces, particularly to handle smaller loads in the smaller plants, was a design problem with Edgar E. Brosius Co. Inc. of Pittsburgh, designers and builders of special equipment for blast furnaces and steel mills. The machine and its modification, the Auto Floor Manipulator, incorporate a number of hydraulic circuits.

The Auto Floor Manipulator, a self contained machine for manipulating forging blanks and hammers under presses, is equipped with hydraulic cylinders for steering, rotation and tilting of the peel, operation of the tongs and on larger models, raising and lowering of the peel to keep the fillet, slab or ingot level. Instead of using a parallelogram raising and lowering motion, a cylinder is provided at each end of the peel so that either end can be raised or lowered independently. This keeps the peel parallel with the anvil dies at all times.

Because of the range of power possible, and the dependability and ease of control available, hydraulic circuits are used extensively in present and proposed designs of this company.

The manipulator illustrated is of 6000 lb capacity and is equipped with a gasoline engine connected in tandem with a generator and oil pump. The generator furnishes power for the tractor motor which drives the machine. In most installations of less capacity drive is by flexible cable and rotating collector ring connection to the plant electric power system.

Some machines have been in continual operation 24 hours per day, and one charger unit operated six years with but one shutdown because of motor trouble.

The extreme mobility of the unit, they can turn on their own wheel base; the complete control by one man of every essential movement for the forge shop or heating furnaces; the low initial and maintenance costs; and elimination of hard, tiresome manual handling has made these machines a real advantage in building production.

USEFUL LITERATURE

(Continued from page 30)

available in 7 styles with bore diameters ranging from 1½ to 14 in for service to 100 psi. Double-end rod type is also available in the same sizes. Detail drawings for all styles of cylinders plus many photographs and constructional diagrams make this catalog complete. In addition several pages are devoted to proper maintenance, conversion of small diameter air cylinders to low pressure hydraulics, general engineering data and accessories and other products offered by this manufacturer.

35. Safety and Relief Valves ... Catalog No. 25 is a general review of the valves produced by Kunkle Valve Company. Safety and relief valves for liquid, air and gas are featured. Relief valves for liquid service can be set at any pressure up to 1200 psi and are available in ½ to 3 in pipe sizes. Safety valves for air are also offered in the same pipe sizes.

36. Hydraulic Tube Fittings ... Catalog F 400 reviews flare and no-flare types of tube fittings produced by Flodar Corporation. No-flare type fittings are available from ¼ to 1½ in tube size in 5 series—straight, 45 and 90 degree, tee and cross. Flare type tube fittings are also available in the same sizes and styles. Several pages are devoted to engineering data and general information on design and use of these fittings. Detail drawings covering all styles of both types are included.

37. Oil Seals ... Catalog No. 947 reviews the various types of oil seals produced by the Chicago Rawhide Manufacturing Company. A complete list of sizes and a number of design drawings of the different seal types are included. Twelve types are offered for service on shaft diameters ranging from ¼ in to 8¼ in. Several pages are devoted to manufacturing methods, installation methods and machine design suggestions.

38. Industrial Timers ... A loose leaf collection of miscellaneous bulletins on automatic controllers produced by Eagle Signal Corporation has been prepared for distribution. It contains: Bulletin 295—industrial timers where intervals are to be timed in sequence; Bulletin 265—repeating cycle timers for process control; Bulletin 262—instantaneous reset timers. Other bulletins covering interrupters, reversing timers, etc. are also included in this collective catalog.

39. Hydraulic Oil Cooler Charts ... A condensed set of drawings and performance curves, for rapid selection of oil coolers for hydraulic applications, are included in data sheets prepared by the Harrison Radiator Division, General Motors Corporation. High heat transfer ratio, plate type oil coolers are featured.

40. Pumps ... The complete line of centrifugal, geared and vane type pumps produced by the Brown & Sharpe Mfg. Co. is included in their 1948 catalog now available. Of special interest are the rotary geared pumps, with helical gears, for low pressure (100 psi) hydraulics. Capacities vary from 1.6 to 16.4 gpm. Other geared pumps with roller bearings have capacities from 4.0 to 34.1 gpm. The same type pump with herringbone gears will serve at pressures up to 500 psi and discharge as high as 37.6 gpm. Photographs and drawings, showing construction details and installations and performance charts for each pump series are included. A special section is devoted to pump accessories.

41. Pneumatic Control Valves ... Bulletin 277-2, published by The Foxboro Company, presents their line of pneumatic control valves and controller accessories. Control valves for open and shut action for on-off control, narrow range proportional action for simple proportioning control and full range proportioning for proportional reset control, are shown in detail. Drawings, charts and engineering data reveal operation and construction details of the main valve types. Special valves for positioning and lever action, in addition to air switches and air filter sets, are also offered. An appendix is devoted to data on valves and lines.

42. Limit Switches ... The Cutler-Hammer, Inc. have available literature on their line of limit switches for industrial applications. The limit switches available are single or double pole, operated by plunger, roller, rod, cam, and wheel action depending on desired applications. Different open-closed combinations are offered for ac and dc work ranging to 600 volts.

43. Air Cylinders ... Cushioned and non-cushioned cylinders produced by Hanna Engineering Works are presented in Catalog No. 234. The cylinders are designed for operation up to 110 psi. Minor modifications make them suitable for 250 psi. Dimensions of standard cylinders are included in chart form for cylinder diameters from 1½ to 14 in. Seven types of mountings are offered with two styles of cushions. Four-way valves, foot operated valves and speed control valves are also presented. They are available for air or oil up to 500 psi, with foot operated units to 250 psi. Detail drawings, an air cylinder capacities chart, and a chart showing fundamental mechanical movements of cylinder setups are included in this 28-page catalog.

44. Worm Drive Hose Clamps ... A 4-page circular—C346—issued by Aircraft Standard Parts Co., Division, Breeze Corporations, Inc., describes and illustrates their line of hose clamps originally designed for Army and Navy aircraft. Advantages of extra long take-up, no loose parts, compactness and high strength are claimed. Worm ends are available in either screw driver slot or thumb grip. Clamp diameter

sizes range from 7/16 to 4½ in. Clamps are available in both cadmium plated spring steel and stainless steel.

45. Hydraulic Cylinders . . . The Logansport Machine Co., Inc., presents their line of hydraulic cylinders in catalog 84. Replacement parts, special cylinders, valves and a hydraulic power unit are also reviewed. The cylinders are available in 7 mounting arrangements, with standard ratio or 2:1 differential and double end type. They are designed for service to 1500 psi. Bore diameters range from 2 to 8 in. The power unit is self-contained and will produce a continuous smooth flow up to 1000 psi. Design details and installations are shown by drawings and photographs. A special section is devoted to charts from which cylinder selections may be made.

46. Air-Hydraulic Devices . . . Valves, cylinders, pumps, pump units and fluid motors are included in the general loose-leaf catalog issued by the Gerotor May Corp. Photographs and detail and design drawings are shown for all units. Cylinders are designed for 150 psi air and 1500 psi oil service. Air cylinders in 7 mountings and diameters to 12 in; hydraulic cylinders are double-acting, standard or 2:1 differential in bores up to 10 in. Four-way air valves are offered for five types of operations and in five sizes. Hydraulic valves are available for 6 types of operations with 4 types of actions. The hydraulic pump units are also shown. Catalog sections on specific equipment will be sent on request.

CORRECTION

Useful Literature, item 55, p 29 of the April issue should read 2000 psi instead of 200 psi. The manufacturer Denison Engineering Company has since notified us that design changes have increased the rating for this 4-way valve to 2500 psi.

New PRODUCTS

For additional information on any of these products, mark the end key numbers on the card bound in this issue and mail the card.

Hydraulic Powerpak

The Powerpak, a control center for hydraulic systems, announced by Electrol, Inc. is designed to meet a wide range of applications in industrial, agricultural and transportation

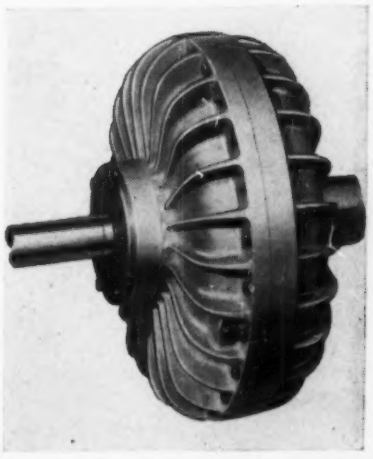
equipment. Capable of exerting precision-controlled forces from 0 to maximum operating pressure of 1500 psi, the compact unit consists of a hand pump, reservoir, selector, relief and check valves. Reservoirs of capacity to meet individual requirements can be supplied; a power driven pump can be incorporated by removing two plugs to connect pump pressure and suction lines to the unit. The ⅛ in NPT ports also can be modified to meet requirements. The unit stands only 4½ in high on a base 3½ x 4 in. Use Business Reply Card, mark NP-1.

Air Pressure Valve

A newly developed air pressure regulating valve is offered by Hannifin Corporation. The valve incorporated an integral knob and adjusting screw that permits close regulation; permanent settings are possible with an adjusting screw locknut. Primary pressure is 150 psi and secondary pressure is adjustable from 5 to 125 psi. An indicating gauge is optional equipment. An additional feature is a fine mesh bronze strainer that can be removed for cleaning. The pressure regulating valve is available in ⅜ in and ½ in pipe sizes. Use Business Reply Card, mark NP-2.

Hydraulic Coupling

The new "Fluidrive" hydraulic coupling manufactured by the Craneveyor Corp. is a simple impeller element and runner unit — a completely self-contained coupling, mounted on its own integrally fitted ball bearings. Extra large shaft-end bearings in the coupling itself assure permanent shaft alignment, prevent shaft play, and possible damage to neoprene



bellows seals. Straight radial vanes make possible operation in either direction; low inertia of impeller and runner facilitates quick stops and reversing duty. This unit is available in two sizes: 8.5 in with capacity

up to 5 hp, and 9.5 in with capacity up to 7½ hp. Use Business Reply Card, mark NP-3.

High Pressure Switch

A new high pressure switch, originally designed for aircraft work, is now in quantity production according to an announcement by Diaphlex Division of Cook Electric Company. It is especially useful where space is

limited. Current rating is 10 amps at 110 volts ac or 2 amps at 28 volts dc. True linear adjustment is available over an operating range from 50 to 5000 psi and the on-off differential is adjustable and ranges from 5 to 50 percent. This high pressure switch is especially applicable to the control of hydraulic systems containing inflammable liquids. Its uses range from heavy plastic molding and metal working to aircraft hydraulic systems. Use Business Reply Card, mark NP-4.

Hydraulic Resistance Unit

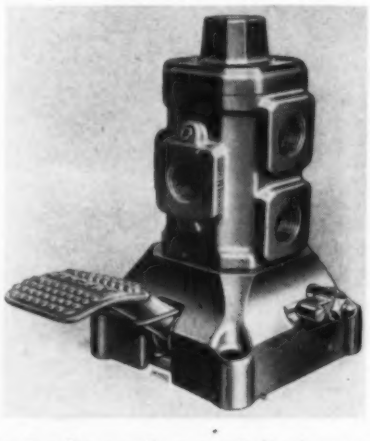
Accurate control of feeding traverse during a cutting operation, air or hand actuated, is obtainable with the Hydro-Check unit produced by The Bellows Co., Senacon Division. It is an adjustable hydraulic unit, offering resistance in one direction only; sets up an opposing, steadying, closely controlled resistance, smoothing out the "springiness" or "bounce" of air. The unit is effective for all types of machine operations, especially drilling, milling and grinding. It is available in six sizes, for checking strokes from 3½ to 17½ in. Use Business Reply Card, mark NP-5.

V-Belt

A nylon-reinforced V-belt with twice the strength and four times the average life of conventional V-belts has been developed by United States Rubber Company. This belt, containing a series of nylon cords covered with synthetic rubber, is recommended for power transmission on equipment subject to rough usage. It is resistant to heat and oil, has high tensile strength, great flexibility and enough elasticity to absorb shock. The belt will be made in fractional and multiple sizes. Use Business Reply Card, mark NP-6.

Foot-Operated Valve

The Logansport Machine Co., Inc. recently introduced a new foot-operated 4-way hydraulic valve for latching or free control of double acting hydraulic cylinders. The new Model 7025 valve is available in standard port sizes from ¼ to 1 in and operating pressures to 1500 psi. Special valves for 2500 psi service are also available. Two types of control are possible with this valve. Selection is made by means of a positioning lever. One position provides for indefinite dwell of machine element after release of foot pressure, and the other position provides automatic cylinder movement with piston returning by spring



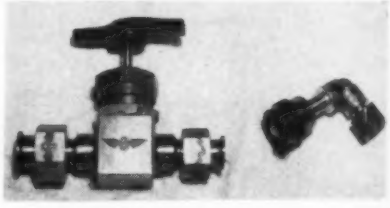
load after release of foot pressure. Use Business Reply Card, mark NP-7.

In-Line Filter

The Micro Metallic Corporation announces production of in-line type filters fitted with porous stainless steel filter elements. These filters are provided with interchangeable elements of three main types; cylindrical, bayonet and star. The units are available in pipe sizes from ¼ to 1½ in with filter areas ranging from 18 sq in to 24 sq ft. Pore openings in the filter elements vary from 20 to 65 microns. Use Business Reply Card, mark NP-8.

High Pressure Shut-Off Valve

A shut-off valve of entirely new design is announced by Greer Hydraulics, Inc. The valve is designed for operation on systems with pressures up to 5000 psi. The manufacturer states that tests indicate safe operation up to 8000 psi. Outstanding features are: ease of installation in any circuit; ability to dismantle working parts



of valve without removal from panel or manifold. Only finger tip control is necessary to turn the valve handle, even under full pressure. There is an extremely low pressure drop across the valve due to the large porting. Use Business Reply Card, mark NP-9.

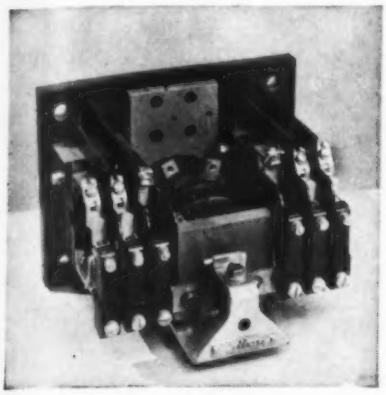
Small Solenoids

General Electric Company, Apparatus Department now has available two new small size solenoids designed especially for safety devices and trip mechanisms. They may be operated from a pushbutton, or automatically by limit switches, pressure switches or other pilot circuit devices. The first model has a maximum pull of 0.26 lb at ½ in stroke; the second has 3.7 lb pull at ¾ in stroke. Use Business Reply Card, mark NP-10.

Heavy Duty Relay

A new heavy duty, rear connected, multiple dc magnet operated relay is announced by West-

inghouse Electric Corporation. The relay is designed for operation on 600 volts and below and is available in from 4 to 14 pole combinations. It features a fast drop-out of the contacts when the coil is de-energized. The new



relay may be had with contacts that operate all normally open or in combination with some contacts normally open and some normally closed. Use Business Reply Card, mark NP-11.

Foot Operated Control Valve

An all purpose foot operated control valve for controlling all types of air cylinders is available from National Pneumatic Company. The valve normally applies pressure with pedal depressed but it is possible with a simple rearrangement of the piping to make valve apply pressure with pedal released. The pedal is enclosed to prevent accidental operation. The valve acts instantaneously from the fully up to the fully down position. All piping can be either ¼ in pipe or ⅜ in OD tubing. Use Business Reply Card mark NP-12.

Hydraulic Oil Filter

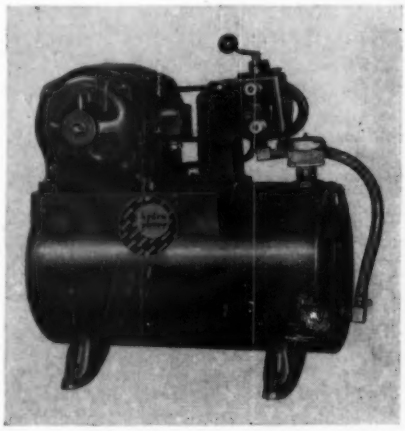
The Skinner Purifiers Division of Bendix Aviation Corp. announces, in Bulletin No. 616, a full flow type hydraulic oil filter for an operating pressure of 1500 psi. The head is an aluminum alloy heat treated casting, with a relief valve opening at 50 psi. This is the fifth filter of this type made by the company. The rated flow is 6 gpm with a clean element. Use the Business Reply Card, mark NP-13.

Synthetic Hose

New buna and neoprene base synthetics are now incorporated in a newly developed synthetic hose produced by the Ronaflex Tubing Company, Inc. This hose will stand up under the punishment of high temperature, pressure, vibration and internal and external action of corrosive solvents. One-quarter inch tubing will stand burst pressures to 1000 psi. Standard sizes from ¼ to 2 in ID in lengths up to 200 ft for smaller sizes and 50 ft lengths for the largest diameters can be supplied. This tubing is particularly applicable to air driven tools and hydraulic tools and equipment. Use Business Reply Card, mark NP-14.

Power Unit

The Hydro-Power, Inc. a subsidiary of the Hydraulic Press Mfg. Company offers the Paul Bunyan Jr., a hydraulic power



unit for use with plant designed hydraulic equipment. The unit contains a 3 gpm 1000 psi pump, a 4-way operating valve with built-in check and relief valves, and suction and return lines from pump to tank. The storage tank with a capacity of 17 gal forms a base for the pump and motor. An electric motor is furnished as standard equipment, but an air-cooled gasoline engine can be substituted. With an electric motor it is only necessary to plug-in to a 220 volt outlet and attach hose lines to actuating cylinder. Use Business Reply Card, mark NP-15.

(Continued on page 36)

BOOK REVIEWS

Pumps, Hydraulics and Air Compressors

Frank D. Graham, *"Audel's Pumps, Hydraulics and Air Compressors." Reprint, first edition. 1658 pages, 4½ x 6½ inches. Published by Theo. Audel & Co., at $4.00.*

This well known practical guide is actually three books in one—pumps, hydraulics and air compressors being treated in separate sections. Treatment is basically simple and direct; the familiar question and answer method is used throughout. Coverage is very comprehensive, however, the emphasis always being placed on the mastery of each unit problem with progression from the simple to the complex. For hydraulic engineers with scant knowledge of pneumatics, or vice versa, the sections on air compressors and hydraulics, respectively, should be very useful. Service and maintenance suggestions throughout the manual will also be helpful. The excellent index is designed to make use of the manual easy.

Applied Industrial Mathematics

O.B. Jones, Instructor in Tool and Production Engineering, Founder of Detroit College of Applied Science. First Edition. 342 pages, 5 3/4 x 9 inches. Published by Prentice Hall, Inc., at $4.00.

The material in this very practical manual has been in process of development since 1926 and has been used in teaching the first term's work to more than 5000 engineering students. The basic mathematics needed for working out specific problems in shop mathematics is clearly and logically presented. There is literally no extraneous material. The text is not a hand-down since the material is the basis upon which more advanced engineering mathematics is taught.

Short chapters set up practical, easy to master units. Nearly

(Continued on page 36)

BOOK REVIEWS

(Continued on page 35)

500 illustrations and over 700 problems at chapter ends makes the manual valuable for review or self-study.

The text is a first rate manual in basic mathematics; its use as a foundation for more advanced study extends its usefulness for many who want a review of fundamentals before they tackle more advanced engineering problems.

Analysis and Design of Translator Chains

H. Ziebolz, *vice president, Askania Regulator Company, Chicago. First Edition, in two volumes, 278 pages (text) and 134 pages (diagrams). 5¼ x 8½ inches. Published by Askania Regulator Company. Price $5.00.*

These two volumes, text and diagrams, were prepared in an effort to establish a systematic approach to the classification of mechanical, hydraulic, electrical, electronic and other technical devices in terms of symbols rather than specific apparatus. The purpose is to reduce elements of mechanisms to convenient index form so that a designer can free his mind from masses of technical detail and to be able to visualize the alternate solutions to a given problem. The author's meaning of translation is to interchange variables, e.g., the Force-Pressure-Stroke System of the mechanical engineer are variables which can be translated by available devices and relays into any other or into others of the same character. Thus, it is possible to translate an input force into an output force, a pressure or a stroke.

The use of block diagrams and symbols is logically carried out from the simplest balancing of an input force and output force to an in-series arrangement with a number of intermediate steps. The treatment is one that will richly repay study by all types of machine and process control designers.

Elements of Mechanism

Peter Schwamb, Allyne L. Merrill *and* **Walter H. James.** *New sixth edition revised by* **Venton Levy Doughtie,** *professor of mechanical engineering, University of Texas. 428 pages, 6 x 9 inches. Published by John Wiley & Sons, Inc. Price $4.00.*

All chapters in this sixth edition of the well known and widely used text have been revised, three chapters have been rewritten to bring nomenclature, standards, illustrations and examples up to date. New illustrative examples have been used and many new problems added to the end of each chapter.

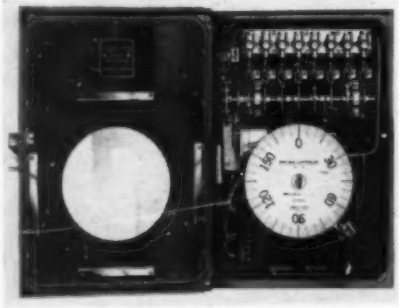
The sequence of chapters has been changed to secure both continuity and additional material, some of which has appeared previously in other chapters, has been added to the final chapter on miscellaneous mechanisms. Laboratory problems are grouped together at the end of the book. Use is made of the simpler method of the calculus, but most of such sections can be omitted without destroying the continuity of presentation. While written as a text for engineering students, the full index, numerous good illustrations and well chosen problems will serve the practicing engineer and designer as a convenient refresher and reference to fundamentals.

NEW PRODUCTS

(Continued from page 35)

Time Cycle Controller

The Bristol Company announces a new multiple-cam time cycle controller known as the Model C500 Impulse-Sequence Cycle Controller for



controlling plant processes where a number of factors must be accurately timed according to fixed sequence.

Time measurement and pilot valve operation are handled by separate mechanisms. Timing is accomplished by a punched aluminum disc with impulse transmitted electrically to the cam operated mechanism. Use the Business Reply Card, mark NP-16.

Pressure Snubbers

A new pressure snubber incorporating porous stainless steel filter discs are now offered by Equipoise Controls, Inc. The disc providing a large surface, prevents clog-up in pressure service. Specially designed filters are available for air and oil. Maximum differential pressure rating for the standard snubbers is 500 psi, but special models for 5000 psi can be supplied. These snubbers will effectively eliminate pressure gauge fluctuations and permit accurate indications of pressure changes. Use Business Reply Card, mark NP-17.

Plug Valve

The Pittsburgh Valve & Fittings Corp. announces a hydraulically lubricated plug valve developed during the war. The unit features positive circulation of lubricant. These Hydro-Lube valves are offered in sizes 1 to 4 in screwed end and 1 x 4 in flanged end for 175 lb service. Additional sizes are scheduled for future production. Use Business Reply Card, mark NP-18.

General Purpose Relay

The Comar Electric Company announces a new general purpose relay rated at 5 amp on 110 volt ac. It is available in any contact arrangement to 4-pole double-throw. Contacts are made of silver and the operating coil is mounted between two insulating plates that carry the contact terminals. Use Business Reply Card, mark NP-19.

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Use it a Thousand Ways, to Push, Pull, Lift, Press, Clamp or Control
Are you familar with the way Hanna Cylinder Power is used to do things quickly, smoothly, accurately . . . how very efficiently Cylinder Power is used in a wide variety of applications to achieve simple, dependable movements for machine control or actuation . . . to make innumerable types of equipment perform better, easier . . . to replace manual effort?
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PERSONALS

DAVID D. WOOD, sales engineer on the staff of the Superdraulic Corporation since July, 1946, has been promoted to general manager, as announced by Harry L. Wise, Superdraulic president. Following his graduation from the University of Michigan in 1939, Wood was associated with his uncle, Gar Wood, in the field engineering service of Gar Wood Industries. Later he became associated with the Benjamin Foster Construction Company, Philadelphia, as construction superintendent on the Indian Rock flood control project. During World War II he served as an engineering officer in the naval air corps, and joined the Superdraulic staff immediately after his release from service.

David D. Wood

BEN LIVERS has been appointed assistant chief hydraulic engineer of the Pacific Division, Bendix Aviation Corp. Previously Livers was chief engineer of Aireon Manufacturing Co.

W. E. QUILLIAN has been appointed chief estimating and purchasing agent of the Salem Engineering Company's southwest branch at Fort Worth, Texas. Until this appointment he served as chief estimator in the company's main office. Prior to his association with this company, Quillian was connected with the Atlantic Steel Company at Atlanta, Georgia.

CLARENCE J. SMITH has been appointed chief engineer of Hydro-Line Manufacturing Co., Rockford, Ill.

WILLIAM P. KLIMENT, standards engineer, engineering and research division, Crane Co., Chicago, has been appointed to the Standards Council of the American Standards Association, New York, by the Manufacturers Standardization Society of the Valve and Fittings Industry.

C. H. STEVENSON, vice president, Lindberg Engineering Company, Chicago is one of the founder members of this organization. The Lindberg Company has just completed an expansion program by adding the sixth new department acquired or originated by this company in the past three years. The Air and Hydraulic Division manufactures hydraulic cylinders, air cylinders and valves.

C. H. Stevenson

FRANK J. WHELAN has been elected a vice president of Worthington Pump and Machinery Corp., Harrison, N. J., in charge of industrial and oil field merchandising activities. He has been with Worthington for 14 years and since 1943 has been assistant to the vice president as well as manager of the Reciprocating Pump Div. He is succeeded in the latter position by Alvin F. Welsh.

WARREN LINDAMOOD has been appointed industrial sales manager for the Meletron Corporation, Los Angeles, Calif. E. C. Asche, who handled these sales previously, will devote his time exclusively to aircraft applications of pressure switches.

ROBERT G. TABORS has been appointed sales manager of the hydraulic press and power tools section of the Baldwin Locomotive Works at Eddystone, Pa. He had been associated with Baldwin from 1937 until World War II. Until recently he was sales manager for the William H. Harman Corp., Wilmington.

CLINTON E. STRYKER has been elected president of Maysteel Products Inc., Milwaukee. He formerly was president of Adel Precision Products Corp. and Aerco Corp., Burbank, Calif. Prior to this he was vice president and assistant to the president of Nordberg Mfg. Co., Milwaukee.

DONALD L. HERR has become associated with the engineering department of Allen-Bradley Co. He will develop servomechanisms for machine tool and other motor controls.

DR. HALDON A. LEEDY, chairman of physics research at Armour Research Foundation, Illinois Institute of Technology has been named acting director of the Foundation, according to an announcement by President Henry T. Heald. He succeeds Dr. Jesse E. Hobson who resigned to accept directorship of the Stanford Research Institute. Dr. Leedy was a physicist in acoustics at Armour Research Foundation from 1938 to 1944. Since 1944, he has been chairman of physics research.

Dr. Haldon A. Leedy

ROBERT W. GREENE has been named tractor plant superintendent for Harry Ferguson Inc., Detroit. He will assist in the direction of production of the new Ferguson tractor.

POST SCRIPTS OF INDUSTRY

NEWS · VIEWS · TRENDS

RODNEY B. CAMPBELL, hydraulic design engineer, has joined the Lynn Co., Burbank, Calif., as chief hydraulic engineer. During the war Campbell was chief engineer of the Aeron Corp., and has been engaged in hydraulic research since the end of the war.

M. M. YARRINGTON has been named general manager and Fred C. Wittig assistant general manager of Aeroil Products Co. Inc., West New York, N. J. Both of these men have been with Aeroil for some years.

FREDERICK R. DICKERSON has been named sales manager of the pump division, George D. Roper Corporation. In his new position he will head sales at the home office in Rockford. Before joining the George D. Roper Corporation in 1936 Dickerson studied engineering at Beloit College and the University of Illinois. After some time in the Roper engineering department he was transferred to the pump sales department where he did consultation work.

Frederick R. Dickerson

HANS BOHUSLAV has joined Engineering Controls, Inc., Los Angeles, as vice president in charge of engineering. For the past five years he had served Sterling Engine Co. in the same capacity.

WALTER C. LEITCH was named vice president and general manager of The Aro Equipment Corp., Bryan, Ohio. He was formerly general sales manager for Gilbert & Barker Manufacturing Co.

GEORGE D. SPOHN has been elected to the board of directors Cutler-Hammer Inc., Milwaukee, to succeed the late Louis A. Lecher.

The Hydraulic Hi-Speed Division of Double-A Products Co. Inc. have announced that the manufacturing facilities for their hydraulic control valves are now located in a larger and more modern plant at Manchester, Michigan. All sales and customer contacts are being handled at the sales office, 5447 Tireman Street, Detroit.

MacMillin Engineering Corporation have moved their offices to 208 South LaSalle Street, Chicago, according to an announcement by Howard F. MacMillin, president.

The Twin Disc Clutch Company of Racine, Wisconsin and Rockford, Illinois announces the opening of a new branch engineering sales office in Los Angeles. The sales functions will be under the supervision of Pierce Tyrrell, assistant west coast district manager. Preston Olney will be branch office manager in charge of parts distribution and field service.

Allen-Bradley Co., Milwaukee, has moved its Detroit headquarters to 11100 E. Warren Ave.

At the annual board meeting, the directors of The Hydraulic Equipment Company, Cleveland, Ohio, re-elected Hall Kirkham, president; Harold J. Zimmerman, vice president; Roy W. Swisher, secretary - treasurer; Carter Kissel assistant secretary. Edward J. Hrdlicka continues as vice president in charge of engineering, Helen M. Nelson as assistant secretary.

The Machinery Manufacturing Division of Milwaukee Chaplet & Mfg. Co., Milwaukee has had its name changed to Rice Pump and Machine Co. R. D. Houghton continues as general manager and sales manager of Rice which remains an operating division of the parent company.

Lindberg Engineering Company, Chicago, has acquired the assets of the Electronics Division of Illinois Tool Works, according to an announcement by C. H. Stevenson, Lindberg vice president. This acquisition completes the expansion program begun by this company several years ago. To take care of this and other recent expansions a new building with 15,000 sq ft of floor space will be erected adjacent to the present plant.

Ross Operating Valve Co., Detroit, has moved to new quarters at 120 E. Golden Gate.

The Brown School of Instrumentation in Philadelphia has recently increased its student capacity, space, and equipment facilities. The school now in its 14th year is conducted for training both customer and Brown Instrument Company service and maintenance engineers. The school will also extend its courses to include specialized subjects according to L. M. Morley, vice president of Minneapolis - Honeywell Regulator Company and its Brown division.

The Special Development Program campaign of Illinois Institute of Technology, through its general chairman Harris Perlstein, announces the appointment of John T. Beatty as chairman of the Mechanical Engineering division. Mr. Beatty is president of the United Specialties Company. His division will be primarily concerned

with the provision of funds for the construction of a proposed new Mechanical Engineering building. Present classes are being conducted in a 47-year old building which is inadequate for this largest of departments on the Illinois Tech campus. The new Mechanical Engineering building will be a $900,000 structure equipped with steam and internal combustion laboratories and a unique machine design-laboratory combination that will enable students to design and actually build industrial machines. The architecture of the proposed building will follow the modern theme set by the five new buildings already completed in the Institute's $15,000,000 expansion program.

The control division of Westinghouse Electric Corp. is in the process of moving its quarters from East Pittsburgh, Pa. to Buffalo, N. Y. G. H. Welch is manager and G. A. Caldwell is manager of engineering of this division.

American Society of Tool Engineers at their annual meeting in March, elected Irving F. Holland, West Hartford, Conn., president; Robert B. Douglas, Montreal, first vice president; Herbert L. Tigges, Toledo, second vice president; V. H. Ericson, Worcester, third vice president; George A. Goodwin, Dayton, treasurer and William B. McClellen, Detroit, secretary.

The Sheffield Corporation, Dayton, Ohio has moved its Detroit office to new quarters at 12800 Puritan Ave.

D. A. Cameron, industrial sales manager, The Parker Appliance Co., Cleveland, announces the appointment of The Standard Brass & Manufacturing Co., Beaumont, Texas and The Globe Machinery & Supply Co., Des Moines, Iowa as distributors. They will handle the complete line of Parker fittings, valves and accessories for hydraulic and fluid handling systems.

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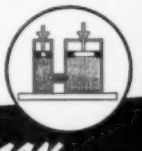

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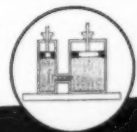

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